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Coming Features

World Power Conference

A special feature of the News Issue of September 19 will be a comprehensive report of the discussions at the sessions of the World Power Conference in Washington. See also the news in this issue.

Industrial Modernization

A panoramic view of what industry is doing in detail electrically to modernize its operations and plant will be the feature content of the October 24 issue.

Special Articles to Come

Appraisal by Candid Camera
Socket Meter Conversions
Motorizing an Envelope Plant.
Spar-Arm T.V.A. Pole-Top
Hydrogen-Cooled Frequency Changer

CONTENTS

SEPTEMBER 12, 1936

Six Months of Appliance Merchandising...53

Details of sales by 132 utilities for the first half of 1936. These load-building items are moving in unprecedented volume.

John W. Davis on Title I 39
At Bar Association meeting Mr. Davis calls the legislation unconstitutional, drastic, unparalleled and punitive.

Insulators Salvaged by Chromium Plating 41
Rehabilitation of corroded caps and pins returns 90 per cent of retired insulators to service.

Full-Length Sound Film Sells Electrified Farming 43
California-Oregon Power Company uses staff talent for educational film that is persuasive.

Standing Poles Given Preservative Treatment 44
Upper New York company proofs poles against insects, fungus and decay by readily penetrating compound.

Voltage Drop Charts for Distribution 46
E. M. Adkins of Jersey Central devises charts aiding distribution layout and revamping.

Electrical Equipment in Building Construction 48
Facilities for erecting and finishing the building are detailed in this comprehensive round-up by G. H. Hall.

Scroll Case Designed on Visualized Hydraulics 61
Bonneville Engineer Cooper tells how slow motion photography of flow in intake and scroll case facilitated improved efficiency in design.

Carter Field on Washington Events 66

Editorials	37 and 64	Men of the Industry	100
Operating Practices	78	New Equipment	106
Power at Work	84	Municipal Items	118
Brewery Data Sheets	88	Recent Rate Changes	120
Engineering Ideas	90	Sales Opportunities	122
Building Up the Load	94	Book Reviews	126

NEWS OF THE WEEK.....68

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This Message appeared in 1,500,000 copies of the New York Evening Sun, September 5th, Special Employment Section, nationally distributed.

What the POWER UTILITIES *mean to* AMERICA

THE Power Utilities have been a prime leader in the creation of real employment in the past. They can mean much in the future to the general welfare of the country. In March, 1935, The Okonite Company published, in part, the following message:

"For nearly sixty years The Okonite Company has supplied its products to all branches of electrical industry.

In the earlier days we saw the railroads doing their historic work as empire builders and clearly demonstrating the progress that can be complished under the initiative of *private* enterprise in America.

Following that, we saw the electric light and power industry [illegible]

investments, from 1926 to 1930, inclusive, shows $843,200,000 spent annually. The years 1932, 1933 and 1934 show a three-year average of $203,000,000. (*The four year average, with 1935 included, is $212,000,000.*)

The greatly increased expenditures in former years were sustaining to many branches of industry now languishing for just such business. The resumption of these purchases would result in putting hundreds of thousands of unemployed men back into factories."

BECAUSE of the strong interrelation between the success of our electric utilities and the success of many other industries, it is the more evident today

ELECTRICAL WORLD

SEPTEMBER 12, 1936

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Looking Ahead at Business

Interest in politics should not obscure the business picture. Preliminary surveys are now under way by manufacturers and utilities to fix bogeys and budgets for 1937. They give a promising business outlook. In fact, prospects are so encouraging that there is a tendency to discount them too greatly.

Based upon business this year and general data on building, reconstruction and manufacturing, several preliminary estimates give an increase of at least 25 per cent as a conservative bogey for electrical manufacturing sales in 1937. Utilities expect at least a 10 per cent increase in industrial load and a larger increase in other classes of business. Yet these figures are gains that come merely from the prospective upturn in general business in this country.

We doubt that these increases give a fair measure of what the electrical industry can do and should do in the coming months. If an organized and aggressive sales effort is put on to augment the effect of this increase in general business there is every reason to expect much larger gains.

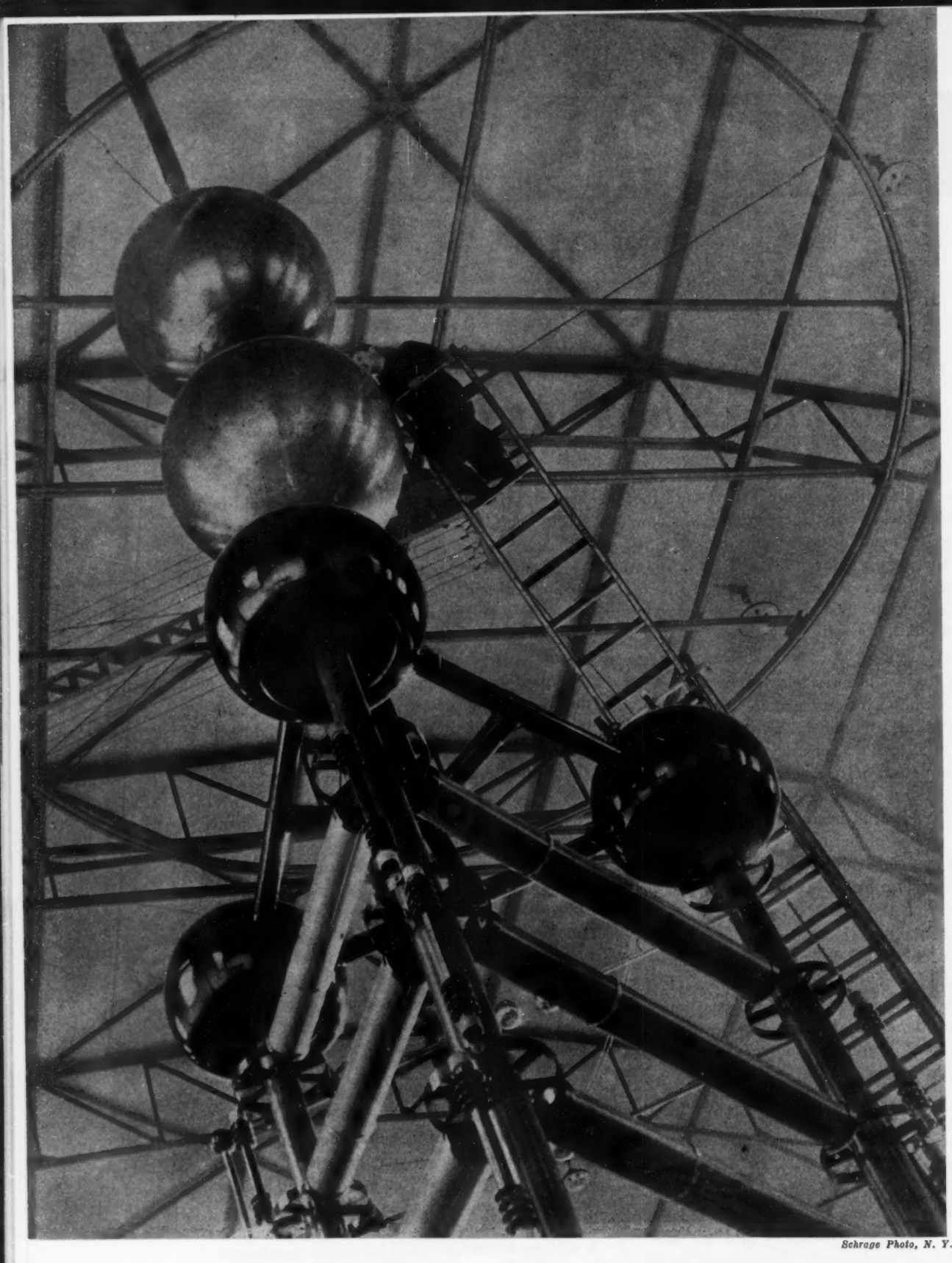
Industrial plants are busy and they are becoming more electrified. Most of them have old apparatus and lack modern electrical equipment and methods. Thus, if, in addition to the pressure of competition and high labor costs, the electrical industry would go after industrial load intelligently there would be an enormous increase in industrial energy and equipment sales. But salesmen of manufacturers and utilities need to gear their efforts to this opportunity. They must meet new conditions. They should have courses in selling and should be brought up to date on modern industrial electrification knowledge. They should be given tangible inducements to sell industry.

Analogous opportunities for selling exist in commercial and domestic sales. Merchants and home owners are sold on the electrical idea. They are receptive to sales efforts. But these efforts must be applied intelligently and on an organized basis to get the volume of business that is available. Past performances and methods are not measures of what to expect and what to do today. Never were conditions so good to get business on a profitable basis.

And the industry has the money and manpower to get the business in the offing. All that it needs is leadership and organization. To date it has approached these markets on a local or on an individual basis. Those who ventured won rewards. But to get the full benefits from present prospects there should be a complete organization and a united front. There should be local and national sales and sales promotion units tied together in an industry plan and directed by a central agency.

We doubt that the electrical industry ever had such a glowing business outlook. And this should offset many of the dark clouds that hover on the political and economic horizon. For if the industry seizes its opportunity and brings its facilities and service to this country in unprecedented volume during the coming months it will go far to overcome its major handicaps. "By their works ye shall know them" is a phrase that has reason for its existence.

Editor



Schrage Photo, N. Y.

WORM'S-EYE VIEW OF NEW IMPULSE MACHINE

This unusual photo shows the so-called "condensator tower" of the 2,500,000-volt high-tension test equipment installed at the research laboratories of Porzellanfabriken Norden, a Danish porcelain factory at Copenhagen. This tower is 30 ft. high and is equipped with ten cylindrical condensers, each of which is charged with 250,000 volts d.c. from a mechanical rectifier. The condensers are discharged in series to produce the 2,500 kv.

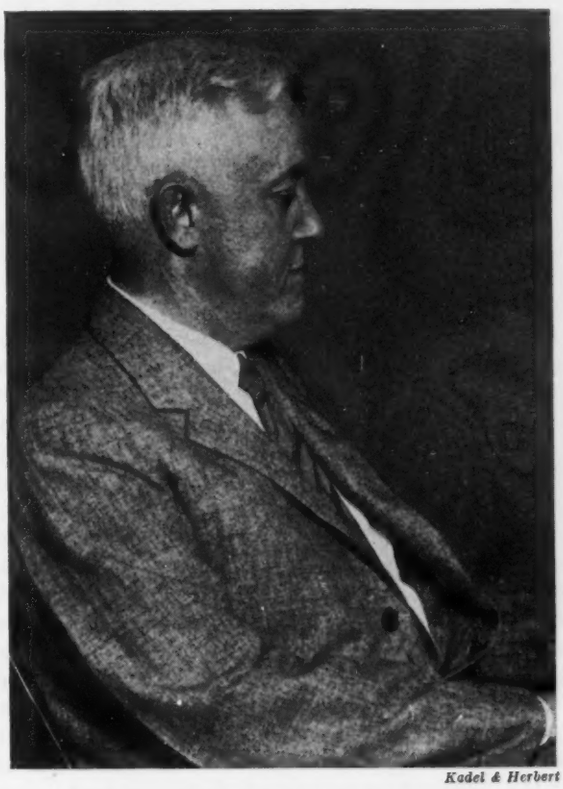
Davis on Title I

Holds Legislation Unconstitutional — Cites Clauses and Reasons for Conclusions — Drastic and Unparalleled Punitive Legislation

AS I SEE Title I of the Public Utility Act, I believe it to be unconstitutional on any one of a number of different grounds. I believe that the subject matter with which it deals is one lying entirely outside of the federal domain. I do not believe that Congress has power to regulate, to control or to dismember and suppress holding companies as such. The act makes the test of jurisdiction upon ownership and ownership alone. An ownership of 10 per cent in any public utility places the owner, by reason of that ownership, in the class of a holding company and is supposed to subject him to federal regulation. I do not know, nor can I find anything in the federal Constitution which expands the power of Congress over any business or any individual simply and solely by reason of his ownership of this, that of the other property, and I do not think the fact that the company whose stock he owns is a utility, therefore dedicated within its sphere to public use, alters that situation the slightest.

Passing that specification of the persons to whom the act is addressed, I think the act is hopelessly bad because it purports, without any discrimination or distinction, to regulate matters which on their face may be either interstate or intrastate, and once the individual at whom the act is aimed is identified by reason of ownership as being within it, all of his activities, interstate or intrastate, are gathered into the regulatory field, and if I correctly read the first employer's liability case (and I know of no case yet that has overruled it) that cannot be done. Nor can the courts rewrite an act so as to exile of their own construction intrastate operations and leave interstate operations alone by judicial constructions within their reach.

I think the act is bad because it violates the Fifth Amendment in usurping the powers of management over private property. Under this act the registered holding company cannot buy; it cannot sell; it cannot borrow; it cannot lend; it cannot issue securities; it cannot retire securities; it cannot retire dividends; it cannot solicit proxies; it cannot contract, and so on down the long list of those things which practically embrace all the activity which the management of any corporation may devote itself to.



Kadel & Herbert

John W. Davis

There is nothing comparable to that in any regulatory statutes, either federal or state, in this country. Thirty-nine years of regulation of the railroads steadily advancing and enlarging from statute to statute has never approached any such supersession of management as is attempted here, and I do not believe, again, unless the Supreme Court shall alter its point of view, that such a supersession of management is regulation within the legal content of that term.

Assume, if you will, that the persons within the act are subject to it, and the activities sought to be regulated are subject to it; assume, if you will, that the scope is not unduly broad—in my judgment the act is bad because it constitutes a delegation of full discretionary power to the commission, with no standard whatever by which the will of Congress may be carried out by the administrative body to which it is committed.

The phraseology in the act, which guides every act of the commission in it, from beginning to end, is simply that the commission should be guided by its conception of the public interest and the interest of investors and consumers, which, as I conceive it, is as if Congress had said to the commission, "Here are your powers. Do well with them. We can give you no other suggestion." I don't believe that is legislation. I don't believe that is an exercise by Congress of its duty to make specific laws by which citizens shall be guided.

I do not believe, in spite of a separability clause, that this act can be dismembered so as to save any part of it. I do not think you can put a pair of shears into this act at any

*Abstract of address by John W. Davis to the American Bar Association Convention.

place or at any paragraph and cut it out and say: "This may survive, though all the rest must fall." I think the court will be compelled to say that the act was intended by Congress as a unitary whole, and if it is fundamentally defective in any of the particulars which reach my judgment, I think the act entire must disappear. So much for that.

Grave threat to liberty

There is something in this act which arouses me far beyond the scope and tenor of the act itself. It may be that in these preconceptions of mine I have been so obscured by the partisanship of an advocate that I do less than justice to the act and to its framers. It may be that by judicial construction or by the wise administration of the commission this act can be given a form and content which really makes of it a guide for conduct, but in one respect the act is entirely unique in the history of legislation in this country, and in one respect it constitutes, I believe, *the gravest threat (and I measure my words in saying it) to the liberty of American citizens that has emanated from the halls of Congress in my lifetime or during the history of that body.* That is strong language. I mean to make it so.

What are the sanctions of this act? How is the compulsive power of Congress sought to be exerted? First, to compel these holding companies so defined to register, and, second, when registered to submit themselves fully to the dictation of the administrative body. The method by which that compulsion is sought to be exerted is that they may not use the mails of the United States in and about their legitimate business. Unless they comply with this act, letter and spirit, they are excluded from the use of the mails of the United States.

And the act isn't content with that. The mails are a government monopoly, made so by statute, accompanied by penal sanctions against any form of competition with them, no matter how trivial. No man may carry a letter for hire in these United States without violating the postal laws. And the government, therefore, has over the mails all the power of a master and creator within the Constitution.

This act goes beyond that and over facilities which the government does not own, in which it has never yet declared a monopoly, whatever may eventuate; over private property, owned and occupied and used by private individuals though for public purposes, over the facilities of interstate commerce—railroads, telegraph, telephone—this act undertakes to exercise a similar dominion and denies to the resistant or non-conforming company the right to use those facilities of interstate commerce in and about its business. If Congress tomorrow should carry through government ownership of the railroads, it would hold them in just the same position that it holds the mails, and would say to every citizen of this country, corporate or non-corporate, natural or artificial person: "Unless you in your individual conduct adopt the standard we erect, you may not mail your letters in this monopolistic facility; you may not mount the railroads and go from place to place; you may not telephone; you may not telegraph. You are put, as it were, by reason of your contumacy under a species of domiciliary arrest."

Now, I deny that power in Congress. I deny it in any legislative body. It is an inconceivable expansion of despotic control of the activities of men. I grant, and all of us grant, that Congress with reference to the mails may classify mail matter, may fix rates for mail matter, may exclude certain mail matter that is deleterious to the public morals or to the public health or the safety of itself or the vehicles that accompany it in transmission. It may protect the mails from destruction or injury. It may prevent them from being used as instruments of fraud. Congress has never attempted to say even to the convicted felon, "We don't like your conduct and because we don't like your conduct you can't write a letter to your wife and send it over the mails." And yet if Congress has this power, if the power exists, it isn't for the courts to say the reason upon which it is based. This is an assertion: Congress as the master of the mails may regulate not only the mails and the use that is made of them, but the conduct of those who use them, and, *ceteris paribus*, the same thing as to the railroads, as to the telephone and to the telegraph.

Title I makes Congress despotic

Public utilities, if you please, are common carriers required under the law of their being to serve all those who desire to use them upon equal and non-discriminatory terms and without inquiry into the motive or the morals or the private life of the individuals on the one hand, or, if you please, of the corporations on the other, who exercise their use. Now they are to be something less than that. They are to be facilities of public character, but Congress will pick out those who are permitted to utilize them and will exile all the rest.

Now, that has never appeared in American legislation before this bill. I make that statement broadly. It has never been adjudicated by the Supreme Court because it has never had a case in which any such power was attempted to be exercised, but when Solicitor-General Bullitt, I think, put forth that argument, the court, in language which cannot be misunderstood, said that although the question was not involved, it didn't want by the slightest implication to sanction the existence of any such federal power.

And I say if that federal power exists, we are wasting our time talking about interstate and intrastate commerce. We are wasting our time in talking about the scope and power of regulatory bodies. We are wasting time inviting the courts to review these questions of balanced power, because the question is over, and by this simple engine of compulsion the Congress of the United States, if it so decrees, becomes the master of the lives and destinies of all the individuals in this country. I don't believe it! And that is what I want to say about Title I.

I am in favor of the private ownership and operation of the power industry, with as much regulation by government—preferably local—as is necessary to protect the public interest, such regulation to be of a character that will not destroy the ability of management to run the business and to make decisions based upon sound economic principles free from political meddling.—FLOYD L. CARLISLE, World Power Conference.

Insulators Salvaged by Cadmium Plating

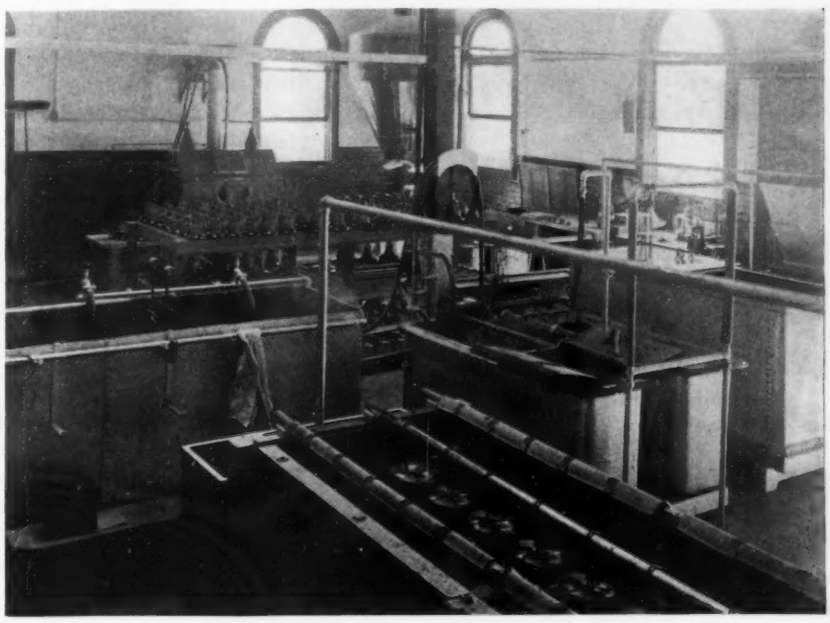
Rehabilitated Corroded Caps and Pins Return 90 per Cent of Retired Insulators to Service — Total Salvage Cost Is Approximately 35 Cents per Unit

By J. B. BOWEN
San Diego Consolidated Gas & Electric Company, San Diego, Calif.

WHEN a utility starts making alterations or repairs to its lines in an effort to eliminate radio interference it is a foregone conclusion that there will be some expense involved. However, in studying a case of radio interference some three years ago a method of treating suspension type insulators was found which solved our problem at a considerable ultimate saving.

During 1932 a 15-mile extension was built on one of the company's 12-kv. rural lines. All of the deadends used on this extension were 10-in. suspension insulators which had been removed from the 66-kv. transmission system during rebuilds and relocations. Due to minor chips in the porcelain or to corroded condition of the steel caps and eye-bolts, these insulators were not considered fit for further transmission line service. They were classified as "B" grade insulators and were issued only for 12-kv. construction. Two of these grade "B" insulators were used on each deadend on this line.

Shortly after the line was placed in service radio interference developed along the entire section just completed. Several weeks were spent in an effort to locate the source of the trouble. Pole-top, air-break switches were adjusted, investigation of three-phase transformers was made, fuses and fuse clips were inspected, loose bonds were tightened, but all of these brought no results. It was noticed while patrolling the line with the radio interference car that the noise seemed to reach its maximum intensity directly under the deadend structures. Using a live-line tool on these structures while looking for loose jumper connections, it was found that the noise intensity was lowered appreciably when the deadend insulators were moved slightly. To find out if the trouble was originating from cracked or otherwise defective insulators, several adjacent deadend structures were rebuilt, using new insulators. The intensity of the noise was definitely lowered.



General view of the cadmium plating plant

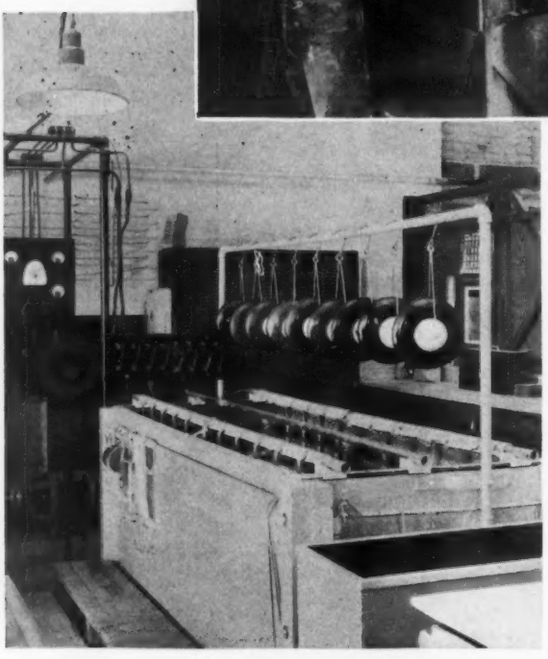
In the foreground is the plating tank and the rinsing tanks. At the far side of the room the air-blast cleaning cabinet and insulator units racked and ready for plating may be seen.

Insulators which were removed were brought into the shop and subsequent testing showed no defects. After further experimental work and a long study of these insulators the conclusion was reached that the noise was caused by a discharge between adjacent insulators due to a very poor contact through the clevis, eye-bolt and clevis pin. In some instances the resistance across this connection exceeded 100,000 ohms.

To change all of the deadends on this line as well as other lines which were causing radio interference would mean considerable expense. The problem resolved itself into a possible treatment of these insulators so they could be used again. Any treatment, to be successful, would have to provide for a contact between metallic parts of high electrical conductivity to be of a permanent nature and to be of such material that heavy corrosion would not occur when exposed to the

Close-up of air-blast cleaning cabinet

Steel grit is used instead of sand as the cleaning medium to eliminate the dust hazard. The porcelain glaze on the insulator is protected by a soft rubber cap during the operation.



Cadmium plating tank and switchboard

Insulators which have been plated are suspended above the tank to drain.

salt fogs which are prevalent along the southern California coast.

Several sample insulators were subjected to various treatments and were placed in an artificial fog tank in order to accelerate weathering. These samples consisted of zinc and cadmium, electroplated, and monel metal which was put on by the molten spray process. The monel metal failed first, due either to improper spraying or the fact that the iron was not a suitable base for this alloy. The zinc and cadmium later deteriorated in about the same manner, the principal difference being that the zinc in the presence of the salt air formed an insoluble deposit of zinc carbonate, sodium chloride and iron oxide. The cadmium did not show any deposit except iron oxide. Accordingly cadmium was selected as the most suitable metal. This choice was influenced to a large extent by the fact that the navy used it for protecting certain parts on its hydroplanes. Also, commercial fishing vessels had made considerable use of it.

It was decided to build up our own plant for this work. The necessary equipment was secured from a plating shop which was no longer in business and installed in an old storage room. A sandblasting cabinet and cyclone for dust collection was built.

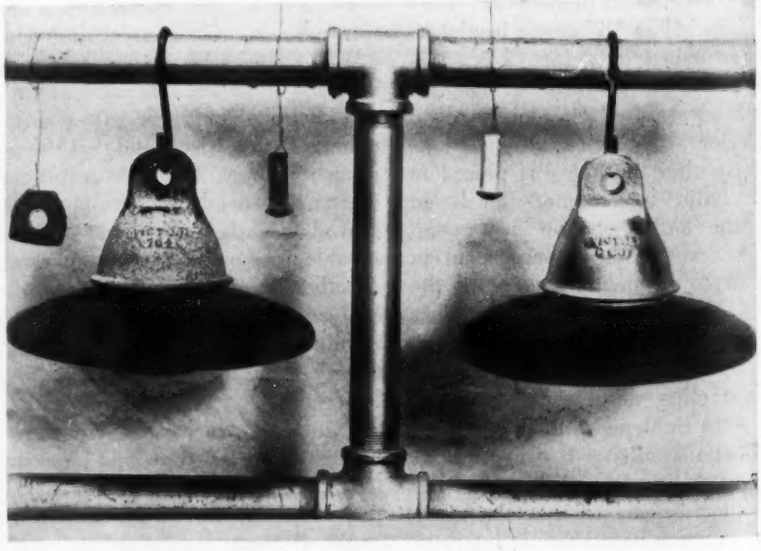
Retired insulators when received were removed from the crates and the strings separated. This operation usually required treating the pins with a small amount of acid, as the insulators when removed from the transmission line were so badly corroded that the entire string of six insulators were rigid. Pins could not be driven out. The insulators were then graded and those with badly broken porcelain scrapped and the balance placed in a solution of sodium bisulphate for stripping the old zinc, if there was any left. They were then washed in water and if necessary scrubbed slightly, after which they were air dried and sent to the sandblaster. Insulators were protected by a soft rubber covering while being blasted in order that the glaze would not be damaged.

A good grade of blasting sand was used, but the dust remained a problem even with a powerful exhauster. After some months a change was made to steel grit, and though somewhat more expensive, it eliminated the difficulties and especially the hazards experienced with the sand.

Oxidation prevented

It was found that the insulators, after sandblasting, must be covered or placed immediately in the plating tank or oxidation would take place. Plating takes place in a sodium cyanide bath at room temperature with about 6 oz. per gallon of free cyanide maintained. Certain organic material is added to the solution in order to reduce the size of the grains and obtain a more dense deposit. The cadmium metal is obtained in the ball anode form, the balls being about 2 in. in diameter and weighing about 1¼ lb. Containers for these anodes were made of steel wire in the form of a helical coil with a closed bottom. These containers are suspended on the anode rods at about 6-in. centers on both sides of the tank. As the metal goes into solution the balls get smaller and drop to the bottom of the container and fresh stock is added. This form of anode is convenient to use and gives a large area

[*Continued on page 110*]



Before and after views of an insulator unit which has been salvaged by the process described in the article

Full-Length Sound Film Sells Electrified Farming

California Oregon Power Company Employees Write, Stage and Produce Popular Feature Motion Picture at a Small Cost—Visual Education Proves Valuable Stimulant to Foster Growth of Rural Load

For an outlay of less than $1,000 this Western company by using its own equipment, directors and staff produced a convincing film that clicks at grange and other rural meetings in promoting farm electrification

EMPLOYEES of the California Oregon Power Company can well be proud of an outstanding achievement in load-building technique. By creating a full-length sound motion picture detailing the benefits of rural electrification in a popular and appealing story they have demonstrated both their versatility and interest in building more business for the company. The accomplishment is all the more creditable because it was obtained with the company's own motion-picture equipment, using utility employees for the cast. From the initiation of the idea to the final showings of the picture before numerous grange meetings all of the work was done by the employees.

Because rural customers of Copco and the Mountain States Power Company are widely scattered, Glenn L. Jackson, vice-president in charge of sales for the two properties, decided that visual education would be the most effective and economical method that could be employed to tell the story of the electrified farm. It was obvious that motion pictures could be employed to advantage in such a program, but it was also obvious that the expense of employing professional talent to produce the pictures was prohibitive.

Investigation revealed that H. D. Kem, assistant sales manager in charge of advertising, was an amateur motion picture cameraman. Conferences with executives in the rural department led to the belief that local talent within the company could be employed to write, direct and supply the cast for a picture. The first picture produced was entitled "Jim Stays on the Farm," a 50-minute feature showing a young college graduate in agricultural engineering taking a reactionary father around the Copco system to show him new ideas in farming. This picture was taken with standard 16-mm. film and sound was supplied by means of a synchronized phonographic disk.

The success which attended the first effort led to a more ambitious venture. As is the case in all educational efforts, the greatest difficulty is that of providing an entertaining and interesting story as the vehicle for portraying the new ideas. The new film is entitled "Electro-Farming" and portrays a typical progressive Oregon farm family at home. In the script a trip to the Annual Farmers' Picnic affords an opportunity to display new electrical applications on the screen by having Jim, the young husband in the cast, tell his neighbors the modern way that he does it on his farm. These applications include stock raising, hay chopping and feed grinding, turkey and poultry raising, electrical tools on the farm, refrigeration, irrigation in many forms, pumping, dairying and others.

The cast included Jim, the young farmer and narrator of the story, who left his desk as system load dispatcher to take the part; Helen, his wife (off the screen the wife of one of the company's accountants in the Medford office), and their child. The last part was taken by the 18-month-old, prize-winning baby daughter of a Medford, Ore., photographer. Farmers at the picnic were ably portrayed by a group of men selected from the company's line crews. All of the electrified farming applications shown in the picture were taken on farms of Copco's customers, some of the shots being easily recognizable by the audiences later to see the film.

For this picture a camera which would take standard sound-track film was rented, although the picture was taken as a silent with the sound "dubbed in" later. This simplified the procedure and saved a great deal of time in making the various shots. In its completed form the new picture requires approximately one hour for a showing. Obviously, no advertising of any nature is included as this would tend to destroy the educational value in the minds of the audience.

This picture is shown free of charge to grange meetings or other special gatherings. A schedule of engagements is obtained by writing to various farm bodies explaining the picture and asking them if they would like to have it shown at one of their meetings. The response to this inquiry has been excellent. From comments noted after the picture had been seen, as well as inquiries received as a direct result of the activity, the utility is convinced that the visual presentation of this type of load-building suggestion is most effective.

Materials, developing and other essential costs incurred in the preparation of the film were less than $1,000. For this expenditure the sales department now has a permanent, interest-arousing and powerful sales tool that can be transported and used easily and inexpensively.

Standing Poles Given

Ground Line Region Proofed Against Insect Attack and Fungus Germination and Spread by Readily Penetrating Compound

That part of a standing pole which is subject to the concentration of bending movement is the part the insects and fungi like. Wood, air, moisture and seasonal temperature combine to make the wood a sweet morsel of food. Protection is a matter of spoiling the appetite of these enemies for wood cells. Penetration is the desired result of fungus spore and insects are not to be attracted into the crevices and cracks. This story gives details of a method of prolonging the strength and texture of the timber.

TO ARREST and prevent ground line decay the New York State Gas & Electric Corporation at Lancaster, N. Y., has recently adopted a new technique for standing poles. The process used combines:

(A) Inorganic and organic salts of proved worth in the prevention of insect attack and decay with a very novel method of securing the desired penetration of the compounds into the wood. The treating material was a compound of sodium fluoride, dinitrophenol, potassium bichromate and gum arabic, known by the trade name of "Osmotite."

Introduction of the compound into the wood is obtained by the natural phenomena known as osmosis, "the mixing of two liquids by passage through a separating membrane." The moisture in the pole is utilized as the vehicle for carrying the preservative into the wood. It is interesting to note that without moisture there is no decay and standing poles, with but few exceptions, contain moisture at the ground line, and it is with this moisture as a medium that the preservative compounds are carried into the wood to prevent decay. The actual treatment was simple, as indicated by the group of pictures on the opposite page.

(B) The first applications were made on August 4, 1935. Six weeks later, on September 28, 1935, increment borings were taken from four of the treated poles. The borings were subjected to color reagents to test the depth of penetration of the preservative compounds. The results of these tests are given in the following table:

Pole No.	Dinitro Zone Protective Agent, Inches	Sodium Fluoride Internal Preservative, Inches
59	$\frac{3}{8}$	$1\frac{1}{2}$
60	$\frac{3}{4}$	2
61	$\frac{1}{2}$	1
62	$\frac{1}{4}$	$1\frac{1}{2}$

The tests made on increment borings indicated that very good penetration was had in only six weeks time.

(C) To secure a complete and accurate report on the depth of penetration, on December 10, 1935, a pole that was treated on August, 4, 1935, was removed. Disks 1 in. thick were cut at 8-in. intervals. Of these disks, three were from the area over which the preservative compounds had been applied. The five others were from that part of the pole above and below ground line. The results of penetration are clearly shown in the illustration at the bottom on the opposite page.

It is interesting to note that penetration extended deeper and around all cracks, thereby immunizing these avenues of decay from attack.

(D) Untreated poles and a surprisingly large percentage of poles treated with a preservative before installation, after eight or ten years upon inspection have been found to be decaying. On treated poles the preservative used prevented attack from the outside, but by using cracks as entrances fungus spore have carried out their destruction from within, leaving nothing but a hollow shell.

(E) The initial applications made by the New York State Electric & Gas Corporation were supervised by one of the field engineers of the Osmose Corporation of America. This company also supplied the preservative materials. The work carried out by the New York State Electric & Gas Corporation at Lancaster was done under the direction of L. K. Brown of the E. M. Gilbert Engineering Corporation.

The achievements of the electric light and power industry reflect the diversification of ownership of important groups of properties, which has led to keen competition for the confidence of the investing public in order that substantial amounts of capital so constantly needed might be made available on the most economical basis to the managements responsible for the development of the respective properties. In the main, this confidence has been well earned and jealously maintained, the few exceptions having served to accentuate the inherent soundness of the industry as a whole and the essentially progressive policies of the public utility managements.—J. F. FOGARTY, World Power Conference.

Preservative Treatment

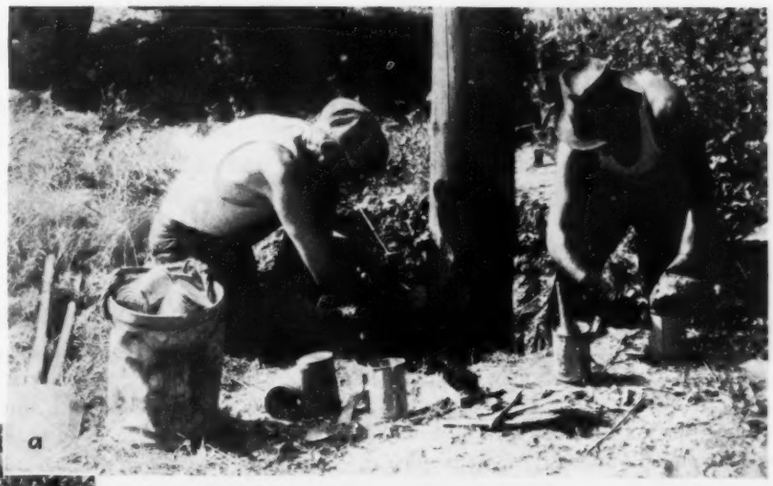
Four Steps in Standing Pole Treatment

(a) A hole about 18 in. deep was dug around the pole. Increment borings were then taken to ascertain the interval condition. From all poles that warranted treatment the outer decay was removed with a small hatchet.

(b) The preservative compound in paste form was then applied by hand with a brush over an area about 12 in. above and 12 in. below the ground line.

(c) The treated area was covered with a waterproof bandage, wound spirally, starting from the top, around the pole. This bandage was held securely with tacks at top and bottom.

(d) The holes were then backfilled.



Penetration deep 6 in. below groundline

The light area is the yellow color brought out by reagents to reveal penetration, which is manifestly deeper around cracks, thus giving these areas extra immunity.

Voltage Drop in Distribution

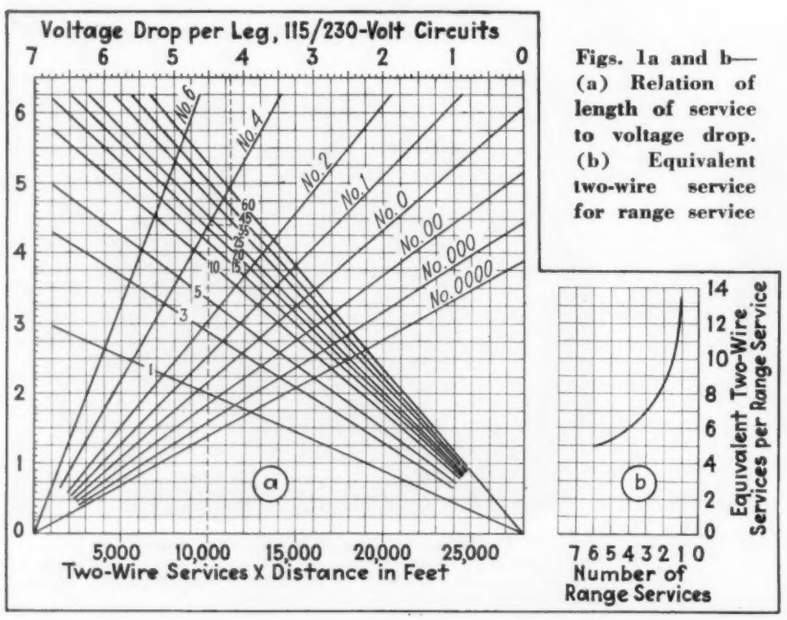
Graphical Charts Simplify the Calculations of Voltage Drop in Distribution Circuits — Example Shows Application — Found Convenient in Use

By E. M. ADKINS
Jersey Central Power & Light Company

A SIMPLE chart for calculating drop voltage on single-phase, 115/230-volt secondary circuits is shown in Fig. 1a. The bottom scale represents the load on the circuit and through use of the method of moments would normally be expressed in terms of kva./feet or kw./feet. However, if some definite kva. demand per two-wire service is assumed the lower scale can be expressed in terms of service/feet. The resulting voltage drop for any size conductor can then be secured by plotting voltage drop on the left-hand vertical scale against load in service/feet on the bottom scale for different conductor sizes and for some given power factor. Since the kva. demand for two-wire service varies, due to diversity, with the total number of services the voltage drop on the circuit for the same load expressed as service/feet will vary according to the total number of services. The lines radiating from the right-hand side of the chart and the scale at the top show the correction, due to diversity, for the voltage drop read on the left-hand scale.

The use of the chart of Fig. 1a is best illustrated by the example of Fig. 2. In the example it is obvious that the maximum drop will occur between the transformer and pole 24 on the right and pole 15 on the left. There are two ranges, one on pole 9 and one on pole 11, on the right half of the circuit. There is also one range on the left half of the circuit on pole 15. Referring to Fig. 1b, the range load may be expressed in terms of euivalent two-wire services, which is 8½ each for two ranges and 13 for one range. Substituting these values for the range services, which makes a total of 32 services on the right half and 35 on the left half of the circuit, the total load in service/feet may be calculated as follows:

Pole 8 to 7	$= \frac{35}{2} \times 100$ ft. $=$	3,500
7 to 6	$= \frac{33}{1} \times 100$ ft. $=$	3,300
6 to 5	$= \frac{32}{3} \times 100$ ft. $=$	3,200
5 to 4	$= 29 \times 100$ ft. $=$	2,900
4 to 16	$= 16 \times 100$ ft. $=$	1,600
16 to 15	$= 15 \times 100$ ft. $=$	1,500
Total, service/feet		16,000
Pole 8 to 9	$= \frac{32}{9} \times 100$ ft. $=$	3,200
9 to 10	$= \frac{23}{2} \times 100$ ft. $=$	2,300
10 to 11	$= \frac{21}{9} \times 100$ ft. $=$	2,100
11 to 12	$= 12 \times 100$ ft. $=$	1,200
12 to 23	$= 5 \times 200$ ft. $=$	1,000
23 to 24	$= 2 \times 100$ ft. $=$	200
Total, service/feet		10,000



Figs. 1a and b— (a) Relation of length of service to voltage drop. (b) Equivalent two-wire service for range service

Reading from 10,000 service/feet on the bottom scale to the intersection of this ordinate with the radial line for No. 4 wire, then horizontally to the intersection of this line with the radial line representing 32 services and thence vertically to the top scale, as is shown by the dotted line of Fig. 1a, the voltage drop on the right half of the circuit is found to be 4.2 volts per wire, or 3.65 per cent. In a similar manner the voltage drop on the left half of the circuit is found to be 6.7 volts per wire, or 5.83 per cent, by reading the drop for 8,000 service/feet and doubling this value.

Fig. 1a is plotted for a load of 90 per cent power factor. A table of correction factors may be worked out for other power factors if extreme accuracy is required. The load used

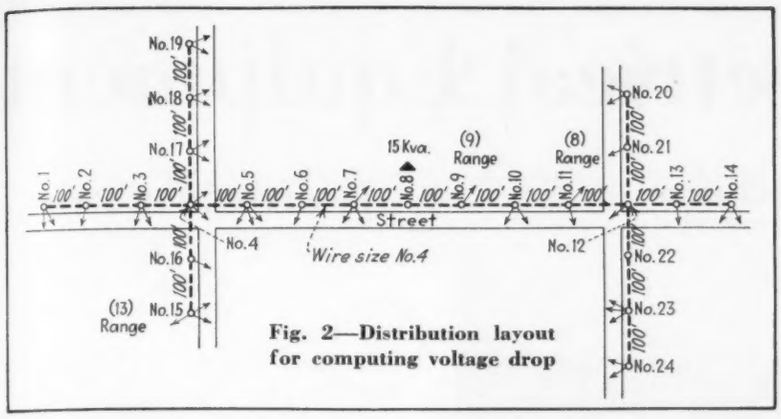


Fig. 2—Distribution layout for computing voltage drop

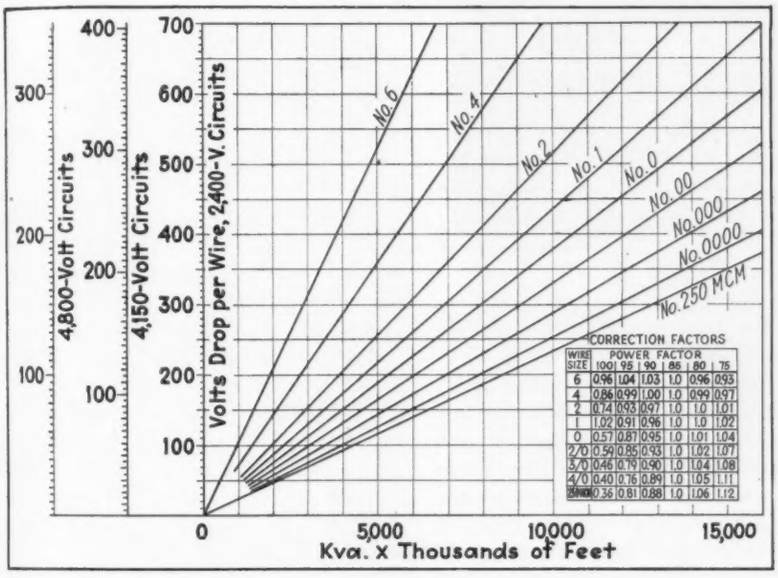
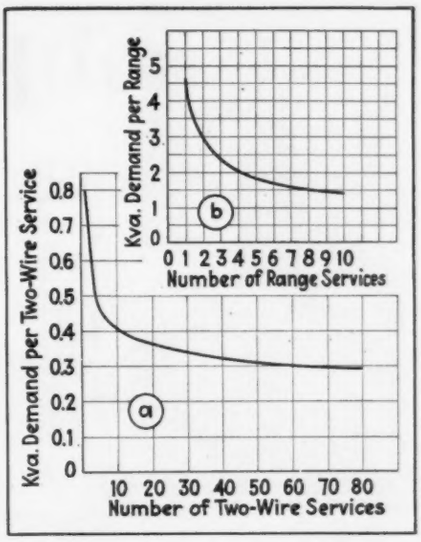


Fig. 4—Chart for estimating voltage drop on primary circuits

in locating the radial lines representing conductor size was 0.35 kva. per two-wire service.

Lines radiating from the lower right corner of the chart, which automatically correct for diversity in proportion to the number of services, are located by means of the kva. demand per service shown in Fig. 3a. The curve of Fig. 1b, which shows the equivalent number of two-wire services per range service, was taken from the diversity curve for electric ranges shown in Fig. 3b. Other types of load may be likewise converted to equivalent two-wire services by dividing the diversified load by 0.35 kva. Diversity curves such as are shown in Fig. 3a and Fig. 3b may be constructed by setting recording ammeters and voltmeters in the secondary circuit and checking the load thus recorded against the number of services. The voltage scale at the left is not essential, but is included so as to illustrate the derivation of the voltage scale at the top.



Figs. 3a and b—Diversity curves for simplifying calculations

In Fig. 4 is shown a chart for estimating the voltage drop on primary circuits. The lower scale, corresponding to load in kva./1,000 ft., is selected because units of 1,000 are more flexible. The voltage drop, read on the vertical scale, is the drop per wire or phase to neutral for three-phase circuits. The total voltage drop for single-phase circuits is $2 \times \sqrt{3}$ or 346.4 per cent of the drop in volts read from the chart for three-phase circuits of the same voltage rating.

The chart of Fig. 4 is plotted for an equivalent spacing of 34 in. A table of correction factors, similar to that shown for power factor, may be set up for other spacing, although the effect of different spacing is quite small.

Rural Construction Practice

Based upon reports to the Federal Power Commission from 308 utilities and as of May 1, 1935, rural construction practices of utilities are given in the table below for four customers per mile and for eight customers per mile. The first and second places only are noted.

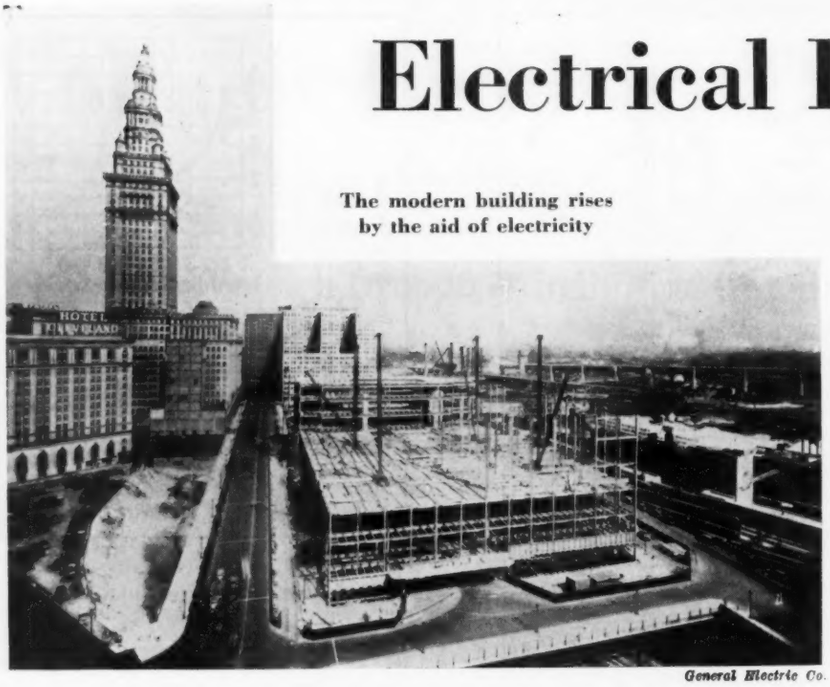
	Four Customers per Mile		Eight Customers per Mile	
	(1)	(2)	(1)	(2)
Pole height, ft	30	35	30	35
Kind of pole	C. Pine	Cedar	C. Pine	Cedar
Length of span, ft	250	300	250	350
Crossarms	2-pin	4-pin	4-pin	6-pin
Guys per mile	4	6	6	4
Pri. conductor	Cu	ACSR	Cu	ACSR
Size	No. 4	No. 6	No. 4	No. 6
Voltage	2,300	11,000	2,300	6,900

	Four Customers per Mile		Eight Customers per Mile	
	(1)	(2)	(1)	(2)
Transformer, kva	3	1½	3	5
Sec. conductors	Cu	ACSR	Cu	ACSR
No. sec. cond.	3	2	3	3
Sec. cond. supports	SR	CA	SR	CA
No. serv. cond.	3	2	3	2
Size serv. cond.	6	8	6	8
Meter capacity	5	15	5	15

SR = Spool racks. CA = Crossarms.

Electrical Equipment

By GEORGE H. HALL
Consulting Engineer, New York



The modern building rises by the aid of electricity

General Electric Co.

FROM the first breaking of the ground for a building until the final finishing of the floors the use of electricity plays as important a part in construction as it later plays in keeping the building in operation. Even before the ground is broken provision must be made for the current which will be used for the operation of the construction machinery and for the maintenance of temporary lighting. This requires a complete switching and metering for which no building is available. Formerly a temporary wooden shack was erected for this purpose. In the equipment for the construction of a modern building the switch house, which now replaces the shack, takes the form of a weatherproof, steel cabinet, which, while temporary in its location, is in effect a permanent piece of apparatus which may be transported from site to site without injury. Such a switch house provides a thorough protection for its contents, and against accidents.

The outside of the steel switch house is coated with corrosion-resisting paint and weatherproof bushings are provided for incoming and outgoing lines. A vertical, sheet-steel barrier separates the front compartment, in which is installed the low-voltage equipment, from the rear compartment, which contains the oil circuit breaker and all other high-voltage devices. As all operation and meter reading is effected from the front, the rear doors may be kept locked at all times to prevent any accidental contact with the high-voltage equipment.

To place in operation it is necessary only to anchor the house in a suitable location, connect the incoming and outgoing wires to their proper leads and make ground connection to the grounding terminal. This type of switch house may be transported intact from one locality to another without disturbing any of the internal equipment or connections.

Digging the Excavation—The power supply having been provided for, the first operation, following the survey and staking out, is the digging for the excavation. For this work the steam shovel has, in the past, played an important rôle which is now being superseded by the electrically operated shovel. With electric drive no time is lost in getting up steam and the shovel is always ready for operation. The services of a fireman are also eliminated, entailing the saving of considerable labor cost. Day and night, if the job is a rush one, and it usually is, the big electric shovel bites into the ground, driving ever deeper and deeper until the excavation is completed and ready for the foundations.

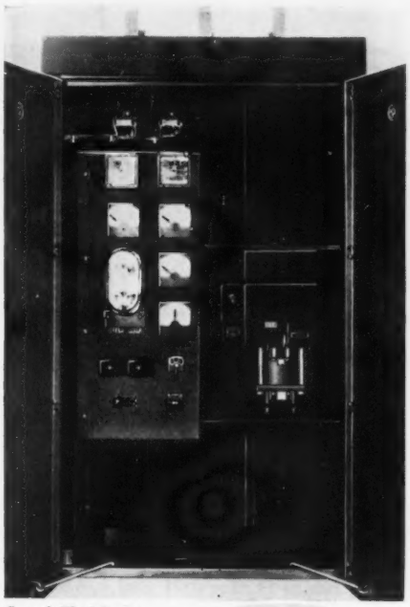
In the equipment of the electric shovel three individual motors are employed for the hoist, swing and crowd motions respectively, and these are, in most makes of shovels, of the direct-current, series type with resistance control. An a.c.-d.c. motor-generator set is included in the shovel equipment to supply the desired operating current.

In some of the latest types of shovels separately excited motors are used in place of the conventional series motors and a generator is provided for each motor. Motor and generator armatures are connected solidly in series

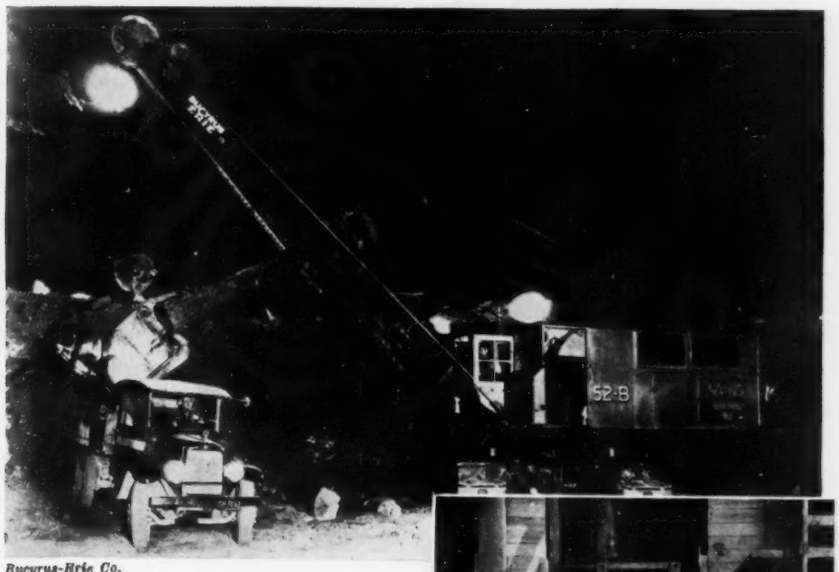
The use of electrical equipment for the operation of all types of machinery that enter into the smooth functioning of an office building, theater, public auditorium or hotel is a practice that is today taken for granted. From the pumps that dispose of the drainage in the sub-basement to the elevator drives in the pent house, all of the multitude of machines and appliances employed for the accomplishment of any desired function are driven by individual electric motors. Any building that is not so equipped can no longer be termed as modern. But there is another phase of electrical equipment that is not so familiar, due to the fact that it is removed as fast as each phase of construction is completed. This refers to the equipment that is employed for erecting and finishing the building which, while of but temporary use, is nevertheless as important in its special field as is the permanent equipment which remains.

in Building Construction

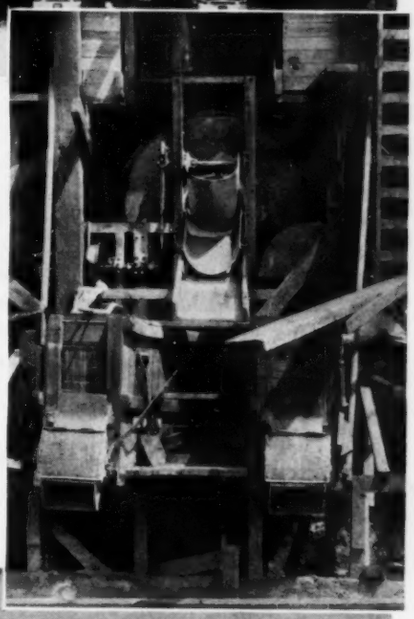
Makes Possible the Construction of Modern Buildings at Less Cost and in a Shorter Time — Welding Saves Steel Frame Tonnage



General Electric Co.



Bucyrus-Erie Co.



Top, left—Outdoor construction cubicle

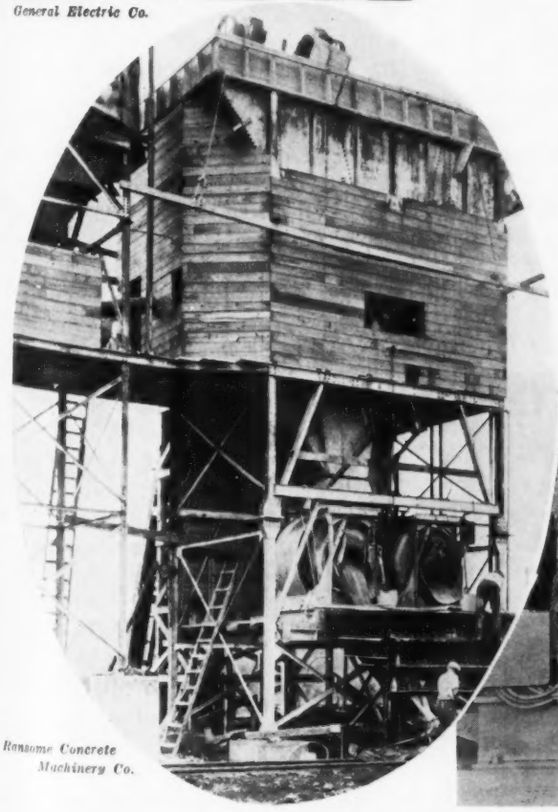
Top, right — Electric shovels dig the excavation

Right, center — Electrically-driven concrete mixer can be located at point of pouring

In oval — Large electrically-driven mixers in a temporary tower

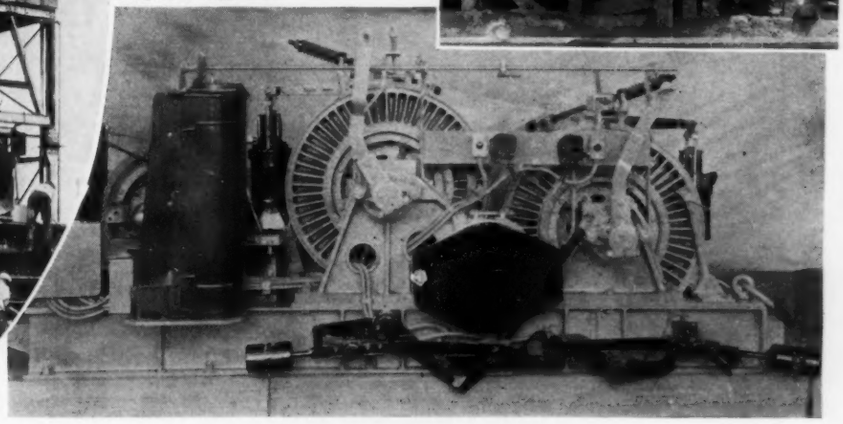
Below—Typical double drum electric construction hoist

Koehring Co.



Ransome Concrete Machinery Co.

Lidgerwood Mfg. Co.



Robins Conveying Belt Co.

Belt conveyors carry material to upper floors

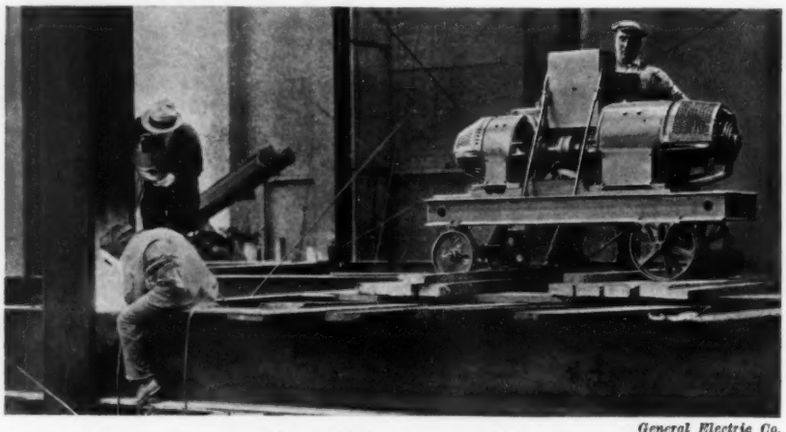
and the generator has self-excited, differential-series-wound fields. Use of variable-voltage control eliminates the need of heavy resistors such as are required for the control of series motors.

Mixing the Concrete—The two factors that have contributed most prominently to the development of modern building construction are concrete and steel framing. The electric concrete mixer is therefore one of the major factors in modern building construction. The mixer consists essentially of a revolving steel drum which is driven by a constant-speed motor and, since drum and drive are integrally mounted on a common framework, the mixer lends itself readily to semi-portable service as it may readily be relocated as the progress of the work proceeds. It may thus be operated in immediate proximity to the work, and the concrete, as mixed, poured directly at the point of use. On large jobs a temporary structure is often erected to contain the mixer, or mixers, with a hopper for the raw material built directly over the drums, into which it is fed through steel chutes by gravity. From the mixing tower the concrete is then dumped into buckets or hand cars or onto a continuous conveyor, by which it is carried to the job.

For pouring floors or walls the concrete is carried in buckets to a temporary elevator, or pouring tower, from which it is run through long chutes or pipes which may be swung so as to deliver the mixture at any desired point. The elevator equipment of such a tower is also electrically operated.

Constant-speed, squirrel-cage motors are suitable for mixer service and they should preferably be of the inclosed, fan-ventilated type, so that entrance of concrete dust into the windings will be prevented.

Erecting the Steel Frame—As soon as the foundations are completed the erection of the steel frame is begun, and in this operation the electric hoist is in service until the last member has been raised into place. As it is one of the most useful, the electric hoist is one of the most flexible of building machines. Consisting of one or more winding drums driven by a single motor, it may be used for operating the derricks, which are themselves raised from floor to floor as the erection of the steel progresses, or it may be employed as the motive power for the temporary outside elevator by which concrete, brick, terra cotta or fireproof wall tiling is carried to the different levels.



General Electric Co.

Arc welding saves steel

Stanley Electric Tool Co.

Electric saw finds many uses

The conventional erection hoist used in connection with the swinging arm derrick consists of two drums, one of which carries the hoisting cable and the other the cable by which the derrick boom is elevated and lowered. In many cases the hoist is also provided with a secondary pair of smaller drums for handling the cable which passes around the bull ring by which the entire derrick is swung around by power, although in the smaller derricks this function may be performed by hand. In some instances a separate single drum swinger hoist is employed for this purpose.

Electrical equipment of the hoist ordinarily consists of a single motor geared or chain connected to the friction shaft of the drum. These drums are free to revolve on their respective shafts, but their motion may be restrained or entirely prevented by the application of foot brakes which are also used for regulating the speed of lowering and thus preventing overriding of the cables. Each drum is engaged at will with its driving shaft through a double-cone friction drive, usually of maple or other hard wood into which cork friction plugs have been inserted. For safety, the intermediate driving shaft is provided with an automatic brake, which may be mechanically or electrically operated.

This will "set" upon failure of the operating current and hold the ascending load from slipping so long as the drum remains in engagement with its frictions.

Contracting or building hoists are essentially one-motor machines, the motor operating continuously. To enable the motor better to pick up heavy loads as they are gradually applied through the frictions, the motor is generally of the series type for direct current and slip-ring type for use on alternating current.

In the case of single drum, elevator hoists, or single-drum boom swingers, the motor is of the reversing type with heavy resistors to provide for gradual starting of the load.

Motor capacity of course depends upon the rated capacity of the hoist and may run from 25 to 150 hp. for either one, two or three drums, since the functions for which the drums are supplied, hoisting, boom raising and swinging, are usually performed separately so that the motor seldom carries the load of more than a single drum at any one time. Swinger hoists employ motors running from 7½ to 50 hp.

Conveying the Material — Mention has been made of the outside, temporary elevator by which material is raised to the various floors. In many cases the erection of such an outside elevator is not feasible, owing to ground limitations, or it may be that a more uniform and rapid flow of material is desired than can be attained with an intermittently operating elevator. Such a demand for continuous delivery of material is met by the use of the endless belt conveyor, whose delivery capacity is limited only by the speed at which the receiving end can be supplied.

The conveyor consists of a frame carrying a terminal pulley at either end, over which an endless belt is kept in continual operation. One of the end pulleys is driven by a constant-speed motor, geared or belted thereto, so that continuous motion is imparted to the belt. Properly spaced rollers between the terminals provide a support for the belt and its load. This belt may be flat for certain services, but for construction work is usually formed into a trough by sloping the sides of the guide rollers. The conveyor is set at an angle so as to extend from the base, or delivery point, to the floor or floors above.

The conveyor shown in the illustration was employed in the construction of a large department store for raising concrete ingredients from the first floor, where they were delivered by trucks, to the floors above in a steady flow. It was 114 ft. in length between terminal pulleys and carried a 30-in. wide belt. In this application the belt was supplied with steel cleats to prevent rolling back of the material since the belt was operated at an angle of 34 deg. For normal operation, up to 20 deg., such conveying belts are not usually cleated.

Since the conveyor may be started when it is fully or partially loaded and is often subject to overloads, the motor employed for its operation should be compound wound for d.c. or slip-ring for a.c. and should be furnished with resistor designed for heavy starting duty.

Ingersoll-Rand Co.

Electric centrifugal pumps keep the water out

Stanley Electric Tool Co.

Electric drills aid installations

Welding the Frame Together — In joining together the steel members of the framework of a building the use of electricity has, until comparatively recently, been subsidiary. Riveting has generally been done by pneumatic riveters, the compressed air for which has been supplied by a motor-driven compressor, but pneumatic riveting cannot be considered as an electrical application, nor have electrical riveters, to any great extent, superseded the pneumatic.

What has, however, placed the fabrication of steel building frames in the class of electrical work is the substitution of electric arc welding for the conventional pneumatic riveting and modern practice is tending more and more toward this replacement. In the matter of convenience the portable arc welding set, or the transformer if

alternating current welding is employed, is easily moved about and may be carried to the level on which the welding is taking place. This dispenses with the long leads of air pipe which, for the pneumatic riveter, must be carried from the compressor, usually in the basement, to the very highest floors.

The saving of steel in a properly designed building frame is a very strong argument in favor of electric welding. As an actual example illustrating this saving may be cited a building recently erected in which the steel required for a riveted structure was estimated at 1,100 tons. When actually erected by use of arc welding but 987 tons were required, a saving of a trifle over 10 per cent.

Added to the saving in the amount of steel is that of reduced labor cost. There are no rivet holes to be punched, thus saving a considerable amount of shop costs, and in the erection the lining up of rivet holes and the riveting of gusset plates is eliminated. In the field work a crew for an electric welder consists of one welder and his helper, as against a riveting gang comprising a rivet heater, passer, riveter and holder-on.

Absence of the customary ear-splitting racket of the pneumatic riveter is not only appreciated by every one in the vicinity of the erection, but in many cases electric welding is the only method by which additions to hotels, hospitals and department stores can be made without rendering the occupancy of the building impossible.

Electric equipment for arc welding consists of as many welding sets as there are welders employed. These sets consist of a portable unit comprising motor and welding generator or, in the case of alternating-current welding, a transformer. Either of these pieces of apparatus is readily connected to the power supply line, while a pair of flexible leads runs from the generator to the welding electrode and the ground connection.

In most localities the excavation is hardly completed before water begins to seep into the hole that has been dug. Such seepage will, in the natural course of events, be taken care of by the permanently installed sump pumps as soon as the building is completed, but, during the process of construction, it must be immediately removed by the use of temporary pumps which operate continuously day and night to prevent interference with the progress of the work.

The simple diaphragm suction pump, with connected motor, is frequently sufficient for this purpose where the seepage is small, but for excavations where any great quantity of water must be removed the direct-connected, centrifugal motor pump is far more practical. In such pumps the impeller is mounted directly on the extension of the motor shaft and the pump housing is flange mounted on the end shield. This provides an integral unit requiring no special foundations nor adjustment. By the use of ball bearings such pumps may be run regardless of any lining up and in any position from horizontal to vertical. As the suction of such pumps is limited to about 15 ft. they must be shifted to new positions as the depth of the excavation increases.

Since the power requirement of centrifugal pumps varies with the cube of the speed, this type of motor pump calls for a low starting torque and is therefore suited to the use of normal starting torque, low starting current, squirrel-cage motors which, up to about 30 hp., may be started

[*Continued on page 116*]

Electrical Graduates Near Average

SOME 137 colleges offering four-year or equivalent courses leading to electrical degrees have turned out 22,472 graduates in this field from 1927 to 1935 inclusive. Individual schools may have fluctuated somewhat, but the surprising fact is that the total number hit a high of 2,891 in the June, 1932, exodus and a low of 2,614 in 1935; the spread is less than 14 per cent of the average. These facts have been brought out by Clifford A. Faust (Ohio Brass Company) in a thorough survey reported in the June-July number of *The Bridge of Eta Kappa Nu.* The study is part of a series to determine the effect of changing economic conditions on the supply of and demand for electrical engineers.

The lag in the low mark until 1935 is, of course, explained by the fact that the freshman class to be affected seriously was the one which entered in the fall of 1931. Early reports for 1936 indicate that the 1936 output will be slightly in excess of 1935, leaving that year to represent the ebb in turnout of electrical graduates.

"It should be the thought in the mind of every senior that he is in competition with approximately 2,800 other men who have successfully completed a regular four-year course or its equivalent in a recognized American college. Even though employment opportunities continue to increase, there will always be keen competition for the better positions."

	1927 -28	1928 -29	1929 -30	1930 -31	1931 -32	1932 -33	1933 -34	1934 -35
Alabama Polytechnic Inst., Auburn	55	59	39	38	43	28	35	37
Armour Inst. of Technology, Chicago	28	47	32	36	30	36	32	28
Brooklyn, Poly. Inst. of, Brooklyn	20	32	32	30	38	40	32	45
California, University of, Berkeley	55	51	53	46	49	55	55	72
Carnegie Inst. of Tech., Pittsburgh	20	20	32	36	33	40	41	34
Case School of Applied Sc., Cleveland	27	17	21	26	34	26	30	18
Columbia University, New York	6	9	8	15	12	14	14	13
Cornell University, Ithaca, N. Y.	42	62	49	37	38	40	26	47
Georgia School of Technology, Atlanta	53	46	41	71	74	79	88	57
Illinois, University of, Irbana	67	68	67	68	55	69	71	55
Iowa State College, Ames	50	54	53	47	46	40	42	38
Johns Hopkins University, Baltimore	19	16	11	12	21	12	17	19
Kansas State College, Manhattan	42	51	55	50	46	45	44	46
Kansas, University of, Lawrence	27	29	27	24	24	22	37	6
Kentucky, Univ. of, Lexington	32	38	42	38	34	44	36	25
Massachusetts Inst. of Tech., Cambridge	179	163	133	142	132	132	109	87
Michigan, Univ. of, Ann Arbor	62	44	46	55	61	36	51	47
Minnesota, University of, Minneapolis	65	66	90	70	52	53	59	59
Nebraska, University of, Lincoln	30	23	30	30	24	18	22	16
Ohio State University, Columbus	60	38	44	40	37	36	23	15
Pennsylvania St. Col., State College	71	69	68	65	62	63	65	61
Pennsylvania, Univ. of, Philadelphia	19	24	12	15	13	9	14	14
Pittsburgh, University of, Pittsburgh	18	10	18	26	29	31	21	20
Purdue University, Lafayette, Ind.	94	135	122	123	128	120	120	121
Rensselaer Poly. Inst., Troy, N. Y.	83	57	78	84	69	86	98	72
Texas, A. & M. Col. of, Col. Station	47	44	54	55	41	46	37	32
Virginia Poly. Institute, Blacksburg	52	40	37	34	40	42	43	29
Wisconsin, University of, Madison	66	51	40	52	43	60	54	50
Worcester Poly. Inst., Worcester, Mass.	38	43	30	29	31	36	34	37
Yale University, New Haven, Conn.	14	18	17	12	11	13	6	8
Total (107 colleges omitted)	2,826	2,779	2,831	2,881	2,891	2,782	2,868	2,614

Appliance Merchandising—A Six-Month Survey

A Study of the Load Building Record of 132 Power Companies —What They Sold—What They Gained

Power companies serving a total of 15,396,010 domestic consumers report their success in domestic load building in this, the sixth survey made by ELECTRICAL WORLD. *About 75 per cent of the entire industry is covered, embracing 111 utilities that sell appliances and 21 that do no merchandising themselves. Local dealer sales are also estimated, with varying completeness, by 102 companies. A study of these tabulations will reveal some remarkable comparisons and reflect an amazing disparity in methods and accomplishment. They provide a basis for profitable self-analysis by individual companies.*

DOMESTIC appliance load continues to pile up at a steadily increasing rate. Power companies sold 22 per cent more merchandise—dollar value—in the first half of 1936 than they did in the same period the year previous, more than they ever did before. Despite the greater effort throughout the country to stimulate the volume flowing through the dealer stores, utility sales are still climbing fast.

The story is told in detail in the following pages, presenting the experience of 132 power companies, serving a total of 15,396,010 domestic consumers, 75 per cent of the entire industry. Of these companies, 111 are actively selling appliances to a total of 11,793,309 households and 21 do no merchandising themselves, leaving the needs of the 3,602,701 families they serve to be taken care of by the local dealers.

The 111 companies that sell appliances operate in communities ranging in size from 772,523 down to 3,342 domestic meters and their total number of household customers on June 30, 1936, was 4 per cent more than the year before (Table I). The total sales of appliances was $41,355,673 for the six months this year, against $33,905,765 in the first half of 1935. In terms of definite appliances, this meant that these power companies this year sold 17 per cent more refrigerators, 27 per cent more ranges, 23 per cent more water heaters, 12 per cent more clothes washers, 18 per cent more ironing machines, 20 per cent more vacuum cleaners and 19 per cent more of all other appliances than they did in the same period of 1935. This was not as spectacular as the gains shown for the full year of 1935, when 103 companies, listed in ELECTRICAL WORLD'S survey, March 14, sold 28 per cent more refrigerators, 65 per cent more ranges and 88 per cent more water heaters than in 1935. But this time we are topping a record year and not a poor one. And it is interesting to note that power company sales of the other major appliances are now running far better than in 1935, when they showed increases of only 2 per cent on clothes washers, 10 per cent on ironing machines, 7 per cent on vacuum cleaners and 12 per cent on small appliances over 1934. The present record shows a more balanced operation.

There is still an unfortunate lack of knowledge among the utilities as to what their local dealers are selling onto their lines. The number of companies that can hazard an estimate of what load is being built by the other retailers is surprisingly small. This time, of the 111 companies reporting, dealer sales were estimated on refrigerators by 83, on ranges by 82, on water heaters by 56, on clothes washers by 58, on ironers by 60, on vacuum cleaners by 43 and on all other appliances by 34 companies.

More laundry equipment is being sold this year, both for load and to provide a more complete service to the home

Domestic Appliance Sales by Power Companies

Table I— Total sales of household appliances by 111 power companies during the first six months of 1936, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas

Company	Total Domestic Consumers June 30	Average Annual Domestic Kw.-Hr. Consumption		Av. Cost for Domestic Service—Cents	Average Revenue Per Consumer	Refrigerators Units Sold By Power Cos.		Refrigerators Units Sold By Dealers Pwr. Co. Est.		Saturation Refrigerators Percent	Ranges Units Sold By Power Cos.		Ranges Units Sold By Dealers Pwr. Co. Est.		Saturation Ranges Percent	Water Heaters Units Sold By Power Cos.		Water Heaters Units Sold By Dealers Pwr. Co. Est.		Saturation Heaters Percent
	1936	1936	1935	1936	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																				
1	772,523	794	778	4.35	$34.57	3,111	3,606			40										
2	[A]739,810	571	528			3,858	2,638				102	36				16				
3	596,724	651	591	4.95	32.21			25,035	19,500	30	4,702	3,691	1,039	515	8	1,844	2,041	330	200	
4	[A]555,124	756	692	4.54	34.38	3,058	2,459	36,649	27,723	46	[D]1,888	[D]642	359	247	4	[D]698	[D]357	74	50	2
5	[A]516,543	792	734	3.94	31.19	1,690	645				3,855	2,775			8	300	16			
6	[AO]511,588	[O]514	[P]488	[O]6.21	[O]31.88	4,005	3,356				1,508	1,183				69	61			
7	316,709	659	634	5.26	34.65	2,340	1,336				619	714	323	132	4	112	67	11	9	
8	[A]309,317	579	541	6.00	35.27	2,457	2,402	9,132	6,096	31	1,475	868	304	216	6	360	426	45	47	
9	[A]299,765	783	687	3.71	29.04	5,511	3,900			32	2,841	1,965	3,549	1,448	14	761	364	249	121	
10	[A]290,122	809	760	4.22	34.17	1,466	1,044	21,100	17,000	36	3	5	55	50	1					
11	[A]243,062	710	663	5.47	38.81	3,806	1,531	11,000			221	206				89	76			
12	[A]230,421	816	778	4.35	35.50	1,565	1,605				[D]744	[D]987				124	203			
13	203,686	829	744	3.43	28.43	721	333	6,500	4,500	25	383	317	472	288	5	[D]439	174	144	101	
14	162,978	805	703	3.89	31.31	3,176	2,491			31	1,695	896	340	157	9	461	194	17	11	
15	158,688	783	727	4.36	34.15	2,057	1,330	6,000	4,000	35	357	842			4	58	135			
16	[A]137,100	522	478	5.34	27.89	1,754	1,169	7,000	4,600		684	345				296				
17	[A]135,912	777	702	5.30	42.25	2,764	1,840	3,200	2,500	40	824	698	350	300		[D]454	[D]324	100	75	2
18	[A]118,021	502	450	6.25	31.39	1,639	1,196	2,620	2,314		962	871	87	36		362	342	9	3	
19	[A]114,176	615	571	5.22	32.12	1,661	809	6,868	4,900	30	123	54	9			53	66	4		
20	[A]100,567	667	628	6.41	42.72	1,022	965				4									
21	92,215	638	563	4.61	29.44	1,196	536		2,200		545	207		50		9	1			
22	[A]91,863	619	542	6.19	38.29	154	211	4,136	3,619	28	63	168	608	445	5	104	344	224	280	
23	[A]89,191	659	619	6.68	44.83	2,145	1,834	2,300	2,000	34	285	170	40	25	5	117	68	5	2	
24	74,195	718	663	5.25	38.13	3,767	2,956	2000	1,200	48	184	[D]133	40	20	3	4				
25	[A]68,504	612	524	5.64	34.54	867	623	1,239	972		542	353	77	44		371	245	68	41	
26	[A]67,094	568	517	5.71	32.40	792	721	1,016	878		509	503	34	32		207	30	4	1	
27	[A]53,576	658	607	5.29	34.80	1,797	1,347	2,500	2,000		511	477	100	75		110	50	3		
28	[A]51,743	603	574	5.42	35.70	488	291				158	136				2[I]	3[J]			
29	[A]49,911	801	707	3.99	31.91	1,491	1,213			39	363	140	13		4	90	70	14	1	
30	[A]48,500	556	501	5.68	31.66	782	684	866	753	25	420	468	141	75	7	36	40			
31	[A]48,334	617	554	6.17	38.07	804	496	2,196	1,264	22	300	200	59	43	4	194	136	35	10	
32	[A]46,543	785	713	4.16	32.66	317	252	1,237			[D]293	105				[D]137	55			
33	[A]43,415	545	539	5.63	30.67	412	325	503	275		281	232	33	16		[D]141	[D]57			
34	[A]41,836	438	409	6.82	29.90	807	[D]703	984	940	26	61	51	11	16	2	13	3			
35	39,814	654	612	6.20	40.62	777	767	1,959	1,735	50	136	173	66	43	8	3	1			
36	[A]39,745	705	608	5.84	41.14	31	40	1,364	1,228	34	33	67	475	626	12	13	47	79	190	2
37	37,744	699	607	4.51	31.50	819	497			26	273	174	18	11	5	44	30			
38	[A]36,395	418	383	5.40	22.21	211	123	1,182	1,031		5	4	25	9						
39	35,346	674	628	5.16	34.74	200	[D]306	1,319	707	28	[D]404	[D]515	79	44	14	[D]46	[D]56	5	2	
40	[A]34,485	556	478	5.40	29.52	1,293	885			29	431	182	10	5	10	142	67	5	3	
41	[A]32,572	555	481	7.70	42.70	232	142	928	728		55	18	20	20		14	4	2		
42	[A]30,597	729	680	5.46	39.85	351	252	1,000			50	27	8			10	7			
43	[A]27,059	657	602	4.65	30.53	382	180			28	104	62	27	21	3	12	16			
44	[A]22,025	620	520	4.87	30.17	455	358	1,800	1,500	51	11	9	5	3						
45	17,185	599	539	3.98	23.81	53	6				75	4				10				
46	[A]15,189	553	521	5.50	30.44	233	170	150	53	21	102	105	20	14	9	16	14			
47	13,234	568	535	6.18	35.12	122	63	475	350	39	7	6								
48	12,812	537	502	5.76	30.94	40	54	175	134	16	105	69	36	13	12	34	37	12		2
49	[A]8,093	557	509	5.41	30.12	36	52	109	115	25	46	41	8	5	13	26	17	4	2	1
Total	7,782,051	[C]650	[C]594	[C]5.26	[C]33.72	68,715	50,742	164,542	116,815	[C]32	29,342	21,894	8,840	5,044	[C]7	8,429	6,283	1,443	1,149	[C]2
II—SOUTHEAST—South of Ohio River, East of Mississippi River																				
50	[A]135,586	1,113	964	3.48	38.73	[D]5,916	[D]5,293	1,162	1,109	54	[D]2,798	[D]2,304	74	35	16	[D]1,659	[D]1,097	19	11	
51	[A]126,305	739	685	4.41	32.60	3,472	3,623				1,745	390				651	311			
52	[A]105,522	967	835	4.03	38.99	107	[D]1,075	8,068	5,596	48	874	[D]1,567	330	156	11	[D]231	[D]1,431	45	40	
53	103,966	1,059	875	3.42	36.22	4,543	4,551			51	[D]2,586	[D]2,336	832	424	21	[D]1,593	[D]1,264	227	108	
54	[A]90,730	1,048	926	3.49	36.59	4,215	4,315			46	[D]1,523	[D]1,137	395	118	21	733	[D]484			
55	[A]75,796	977	854	5.78	56.33	138	187	6,081	5,804	41	374	447	1,391	900	18	252	294	719	638	
56	[A]70,197	645	595	5.13	33.08	1,190	948	2,400	2,300	40	42	31	5	5	2	5	2			
57	60,916	940	758	4.16	39.05	908	2,405	5,220	2,818	46	965	1,257	483	53	19	469	556	129	8	
58	53,576	642	553	4.44	28.50	390	935	5,138	4,451	43	12	8	63	27	2	1	1	12		
59	[A]42,348	546	489	6.04	32.98	480	351	2,201	1,192	34	323	283	85	53	7	117	116	20	9	
60	[A]30,658	667	611	5.70	38.14	278	304	2,153	3,597	40	151	87	91	203	9	41	24	28	26	
61	27,603	703	619	4.87	34.20	1,274	983		700	32	120	145			11	118	60			
62	[A]27,156	568	516	5.80	33.05	325	308	1,650	1,494	40	142	70	80	29	6	2	5	5		
63	24,042	754	668	5.40	41.85	433	367	462		45	264	312	64	35	12	257	244	42		
64	[A]17,669	997	826	4.06	40.51	454	672			41	248	[D]161			14	[D]153	[D]119			
65	14,805	893	814	4.30	38.54	[D]137	[D]113	1,000	900	39	[D]233	[D]240	10	48	14	[D]86	[D]73		12	
66	[A]13,188	772	674	4.70	36.61	515	332	832	1,074	52	48	52	60	23	7	16	12	12	2	
67	[A]10,830	915	703	5.19	47.52	82	337	441	621	57	51	129	77	127	18	36	85	46	73	
68	[A]10,204	892	759	4.71	42.03	480	163	536		47	149	99	36		15	94	5	21		
Total	1,041,097	[C]834	[C]722	[C]4.69	[C]38.19	25,337	27,262	37,344	31,656	[C]44	12,648	11,055	4,076	2,236	[C]12	6,514	6,183	1,325	927	[C]9

[A]Operate some gas service also. [B]Weighted average. [C]Straight-line average. [D]Includes rentals see Table IV. [E]Discontinued selling. [F]Electric and gas. [G]Major appliances only. [H]Included with all other appliances. [I]All advertising. [J]From company and dealer sales.

and Local Dealers for the First Half of this Year

Comparisons of these sales totals with the same period of 1935, with data on average consumption, rates, revenues, saturations, sales totals, sales people and advertising expenditures—embracing nearly twelve million consumers

Clothes Washers Units Sold By Power Cos.		Saturation Clothes Washers Percent	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines Percent	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners Percent	All Other Appliances Units Sold By Power Cos.		Total Sales of All Appliances By Power Cos.		Power Co. Appl. Sales Per Consumer	Annual Revenue Increase from Power Co. Sales	Number Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Advertising Expenditure		Advertising Per Consumer	Company
1936	1935	1936	1936	1935	1936	1936	1935	1936	1936	1935	1936	1935	1936	1936	1936	1935	1936	1936	1935	1936	
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																					
1,752	1,654	50	622	486	6	3,040	1,994	79	67,822	47,735	$2,067,387	$1,763,261	$2.68	$.....	456	476	1,694	$164,841	$158,694	$0.21	1
5,045	3,045	.....	1,135	592	.....	3,259	2,737	.....	29,515	23,681	1,547,050	1,018,430	2.09	.....	341	277	2,170	.....	.....	.....	2
											757,573	675,883	1.27	[N]777,725	[U]135	[U]130	4,420	60,000	48,000	0.10	3
1,440	1,472	46	281	237	3	537	588	82	10,980	11,389	1,122,648	875,855	2.02	330,000	215	218	2,582	88,358	90,910	0.16	4
[#]44	491	.....	106	127	.....	[E]194	387	.....	21,580	18,311	826,469	474,133	1.60	.....	65	21	7,947	163,000	162,000	0.32	5
2,322	1,631	.....	478	445	.....	1,691	991	.....	16,522	9,787	1,311,036	1,040,442	2.56	315,091	231	221	2,215	51,342	66,021	0.10	6
1,101	638	.....	196	95	.....	1,526	464	.....	18,297	9,757	779,452	463,753	2.46	125,000	[Q]49	[Q]29	6,463	92,655	51,272	0.29	7
1,218	1,129	60	141	223	5	661	426	65	9,893	7,137	861,040	842,400	2.78	157,612	296	285	1,045	91,590	67,220	0.30	8
1,493	1,578	.....	397	361	.....	1,591	1,731	.....	.....	.....	[F]1,909,435	[F]1,455,142	6.37	.....	150	.....	1,998	.....	.....	.....	9
1,118	1,136	61	339	365	16	846	911	63	6,975	5,631	578,946	462,224	2.00	97,846	40	40	7,253	13,871	14,854	0.05	10
1,239	1,615	.....	315	300	.....	1,192	1,297	.....	17,928	17,498	971,076	594,013	4.00	.....	90	71	2,700	[S]130,000	44,500	0.53	11
1,371	1,410	.....	124	52	.....	894	737	.....	7,640	6,704	678,315	689,681	2.94	.....	213	188	1,082	.....	.....	.....	12
522	726	80	48	57	4	859	651	65	12,500	10,750	350,000	300,000	1.72	55,000	60	40	3,395	35,000	30,000	0.17	13
1,264	1,066	.....	345	427	.....	1,063	644	.....	.....	.....	1,179,415	839,588	7.24	.....	265	.....	615	.....	.....	.....	14
602	663	85	145	162	4	432	534	.....	.....	.....	607,919	558,908	3.83	70,000	130	145	1,221	20,500	29,200	0.13	15
											392,106	287,840	2.86	64,738	100	70	1,371	23,921	22,466	0.17	16
622	633	.....	92	24	.....	438	461	.....	.....	.....	751,775	536,636	5.53	[J]210,000	104	85	1,307	34,979	25,925	0.26	17
553	549	50	189	129	15	254	240	60	6,117	4,297	510,087	410,959	4.32	70,023	75	65	1,574	12,600	20,200	0.11	18
225	359	.....	19	50	.....	.....	.....	.....	.....	.....	338,957	188,702	2.97	48,787	49	48	2,330	30,000	30,000	0.26	19
206	186	.....	32	53	.....	337	186	.....	.....	.....	176,197	188,482	1.75	.....	26	24	3,868	.....	.....	.....	20
113	262	.....	46	88	.....	157	144	.....	1,464	930											
143	108	.....	40	25	.....	47	48	.....	1,791	1,228	293,634	124,409	3.18	.....	57	20	1,618	26,950	23,053	0.29	21
19	28	.....	10	11	.....	.....	.....	.....	.....	.....	49,230	108,785	0.54	154,468	30	35	3,062	13,500	16,500	0.15	22
354	295	40	80	40	.....	408	472	57	1,349	1,122	483,003	430,792	5.42	120,885	47	36	1,898	39,774	25,784	0.46	23
771	616	65	186	122	15	419	258	60	.....	.....	993,889	743,271	13.40	300,000	140	100	530	33,038	25,958	0.45	24
244	257	.....	77	33	.....	.....	.....	.....	.....	.....	319,123	228,261	4.66	50,096	72	60	951	8,003	7,542	0.12	25
765	797	.....	131	130	.....	162	137	.....	.....	.....	400,291	306,463	5.97	109,107	44	53	1,525	10,327	14,378	0.15	26
728	530	.....	52	42	.....	305	190	.....	2,416	2,870	539,233	389,253	10.06	90,313	68	65	788	14,000	13,500	0.26	27
		.....	40	24	.....	.....	.....	.....	.....	.....	98,166	64,203	1.90	28,626	6	6	8,624	2,237	1,916	0.04	28
496	298	.....	89	75	.....	341	331	.....	.....	.....	[F]576,676	[F]398,171	11.55	.....	75	.....	665	.....	.....	.....	29
417	464	.....	183	162	.....	[H]	[H]	.....	1,943	2,109	307,804	294,800	6.35	42,919	37	33	1,311	4,473	6,400	0.09	30
78	60	87	24	10	5	[T]	[T]	89	.....	.....	220,876	150,732	4.57	[J]101,044	30	35	1,611	9,513	15,402	0.20	31
159	139	.....	21	35	.....	270	227	.....	1,964	1,671	125,513	107,629	2.70	.....	27	26	1,724	3,079	3,694	0.07	32
380	356	.....	93	85	.....	208	103	.....	3,470	2,536	194,056	161,135	4.47	31,339	19	22	2,285	3,665	1,337	0.08	33
213	99	.....	101	6	.....	79	63	.....	2,151	1,884	204,513	152,786	4.89	19,200	62	.....	675	4,394	3,895	0.11	34
20	23	25	4	3	5	175	50	60	1,289	1,239	169,756	174,437	4.26	76,377	20	15	1,991	8,056	6,422	0.20	35
2	5	.....	.....	2	.....	.....	.....	.....	.....	.....	14,991	21,825	0.38	62,774	12	11	3,312	6,500	8,500	0.16	36
482	448	.....	98	94	.....	208	189	.....	.....	.....	266,152	182,573	7.05	.....	75	.....	705	.....	.....	.....	37
[T]	[T]	.....	[T]	[T]	.....	[T]	[T]	.....	[T]	[T]	50,979	35,474	1.40	47,643	9	9	4,044	1,448	2,653	0.04	38
93	152	32	15	23	.....	130	164	68	2,464	6,869	80,083	71,370	2.27	44,321	38	37	930	5,003	5,923	0.14	39
327	276	74	19	19	2	865	791	64	881	897	267,259	221,154	7.75	37,854	23	18	1,499	7,214	5,389	0.21	40
127	92	.....	28	25	.....	35	48	.....	715	265	56,478	43,780	1.73	16,413	12	12	2,714	2,761	2,843	0.08	41
318	336	.....	52	35	.....	252	322	.....	2,668	1,766	169,372	146,931	5.54	21,184	22	20	1,391	8,151	6,695	0.27	42
144	104	.....	32	11	.....	215	170	.....	.....	.....	[F]298,400	[F]190,806	11.03	.....	35	.....	773	.....	.....	.....	43
224	170	83	15	13	3	123	102	76	1,086	731	109,505	88,530	4.97	12,500	14	11	1,573	3,200	3,100	0.15	44
12	3	.....	.....	4	.....	3	1	.....	91	119	22,453	4,893	1.31	.....	5	.....	3,437	2,858	2,666	0.17	45
102	109	.....	32	4	.....	[H]	[H]	.....	408	433	83,898	51,705	5.52	7,824	10	8	1,519	1,111	1,396	0.07	46
[T]	[T]	75	51	25	7	[T]	[T]	72	[T]	[T]	29,711	15,247	2.25	12,000	3	3	4,411	3,957	3,290	0.30	47
39	111	.....	22	17	.....	.....	.....	.....	.....	.....	36,885	34,273	2.89	11,310	10	8	1,281	903	991	0.07	48
18	28	.....	12	9	.....	.....	.....	.....	.....	.....	17,560	18,850	2.17	6,236	14	12	578	1,444	1,399	0.18	49
28,925	26,147	[C]61	6,557	5,357	[C]7	23,216	18,789	[C]69	251,919	199,346	24,196,372	18,628,870	[B]3.11	3,716,255	4,106	3,086	[B]1,895	1,238,216	1,071,888	[C]0.19	Total
II—SOUTHEAST—South of Ohio River, East of Mississippi River																					
607	364	.....	149	41	.....	530	582	.....	.....	.....	[F]1,533,097	[F]1,374,291	11.31	.....	185	.....	733	.....	.....	.....	50
4	22	.....	9	5	.....	210	213	.....	13,874	9,908	987,530	815,326	7.82	.....	50	50	2,526	80,000	80,000	0.63	51
31		.....	5	.....	.....	25	.....	.....	2,356	.....	102,502	58,711	0.97	[G]260,200	42	44	2,512	14,300	30,000	0.14	52
466	312	.....	93	92	.....	328	370	.....	.....	.....	1,366,970	1,151,449	13.15	.....	175	.....	594	.....	.....	.....	53
466	420	.....	52	29	.....	79	110	.....	.....	.....	878,957	888,893	9.69	.....	100	.....	907	.....	.....	.....	54
49	33	.....	15	4	.....	35	25	.....	6,625	6,375	171,824	173,426	2.27	46,052	45	43	1,684	57,210	63,000	0.75	55
467	40	60	67	65	3	404	.....	56	2,948	2,583	360,815	256,712	5.14	45,949	30	24	2,340	13,264	12,759	0.19	56
37	224	.....	.....	.....	.....	42	167	.....	10,835	13,763	490,764	753,098	8.06	237,508	78	78	781	31,338	23,418	0.51	57
31	55	15	2	3	2	64	117	50	21,645	26,897	133,384	162,771	2.49	22,235	58	45	924	19,804	32,446	0.37	58
208	190	.....	47	39	.....	.....	.....	.....	.....	.....	179,877	157,664	4.25	71,955	23	15	1,841	11,546	11,415	0.27	59
46	38	2	8	4	.....	97	36	25	5,619	8,508	107,541	99,008	3.51	26,357	40	29	766	26,941	[I]40,061	0.88	60
67	136	.....	9	44	.....	38	27	.....	.....	.....	288,011	224,889	10.43	.....	60	.....	460	.....	.....	.....	61
17	16	15	3	4	1	.....	.....	.....	.....	.....	72,159	70,583	2.66	58,123	13	11	2,089	3,000	1,000	0.11	62
		.....	.....	.....	.....	.....	.....	.....	.....	.....	132,683	135,720	5.52	52,834	20	20	1,202	8,106	7,619	0.34	63
51	42	.....	5	2	.....	81	38	.....	.....	.....	[F]216,499	[F]220,722	12.25	.....	18	.....	982	.....	.....	.....	64
6		.....	.....	.....	.....	10	5	.....	858	557	52,103	50,514	3.52	43,860	9	8	1,645	5,514	5,042	0.37	65
1	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	89,908	71,082	6.82	12,870	8	7	1,649	4,990	5,100	0.38	66
2	5	.....	1	2	.....	.....	.....	.....	.....	.....	30,649	68,964	2.83	[J]32,770	12	12	903	2,540	4,335	0.23	67
88	37	.....	3	.....	.....	19	21	.....	.....	.....	170,911	[P]70,329	16.75	.....	18	.....	567	.....	.....	.....	68
2,644	1,939	[C]23	468	334	[C]2	1,962	1,711	[C]33	64,760	68,591	7,366,184	6,804,152	[B]7.08	910,713	984	386	[B]1,058	278,553	316,195	[C]0.40	Total

[E]Incl. portable lamps and lighting fixtures. [L]All classes of consumers. [M]All employees act as salesmen. [N]Includes E.A.R. from dealer refrigerator sales. [O]As of December 31, 1935. [P]As of December 31, 1934. [Q]Does not include sales people in 33 stores. [S]Included $71,000 spent for institutional series. [T]Do not merchandise. [U]Excluding women.

(Continued)

Domestic Appliance Sales by Power Companies

Company	Total Domestic Consumers June 30	Average Annual Domestic Kw.-Hr. Consumption		Av. Cost for Domestic Service—Cents	Average Revenue Per Consumer	Refrigerators Units Sold By Power Cos.		Refrigerators Units Sold By Dealers Pwr. Co. Est.		Saturation Refrigerators Percent	Ranges Units Sold By Power Cos.		Ranges Units Sold By Dealers Pwr. Co. Est.		Saturation Ranges Percent	Water Heaters Units Sold By Power Cos.		Water Heaters Units Sold By Dealers Pwr. Co. Est.		Saturation Water Heaters Percent
	1936	1936	1935	1936	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936	1936	1935	1936	1935	1936
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																				
69	[A]310,067	749	641	4.69	$35.12	2,400	3,205	12,500	12,200	32	1,804	2,395	1,089	518	9	1,339	1,785	550	274	2
70	[A]253,802	896	844	3.31	29.66	671	452	26,196	25,192	56	498	371	1,073	420	3	.....	.....	.....	.....	.....
71	96,256	826	774	4.53	37.33	1,034	961	.....	.....	.....	[D]944	[D]642	.....	.....	.....	[D]316	[D]240	.....	.....	.....
72	93,388	691	637	4.60	31.15	751	669	7,586	6,366	40	26	5	7	6	1	9	3	.....	.....	.....
73	[A]78,346	495	468	6.30	31.38	503	329	1,390	913	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
74	64,803	746	687	4.81	36.31	.....	.....	5,903	5,367	45	6	5	39	11	1	.....	.....	9	.....	.....
75	58,855	811	740	4.59	37.22	310	255	3,948	3,212	52	68	41	48	14	5	57	14	11	1	1
76	56,471	699	664	4.83	33.72	205	157	4,125	4,128	47	143	72	84	37	3	63	2	16	1	.....
77	49,154	655	595	5.80	38.30	882	938	3,456	2,995	30	343	234	20	14	4	119	78	.....	3	1
78	[A]49,008	622	578	6.36	35.68	960	593	1,200	950	40	68	44	15	10	4	10	5	5	3	.....
79	46,811	610	580	5.75	38.72	811	589	6,163	3,333	.....	100	42	33	6	.....	19	13	3	.....	.....
80	41,616	747	681	5.74	42.94	1,201	1,038	707	705	42	451	413	10	7	12	205	130	2	1	3
81	39,108	813	705	5.34	43.40	1,419	1,434	2,395	2,773	48	669	502	15	10	10	279	153	.....	.....	3
82	[A]38,286	626	524	4.97	33.15	[D]657	282	1,257	1,142	22	[D]176	[D]174	14	.....	5	[D]216	[D]285	.....	.....	4
83	37,278	713	659	4.69	33.45	212	105	699	225	18	275	155	84	51	12	126	108	9	3	2
84	[A]32,491	821	749	5.08	41.69	1,513	2,975	408	959	.....	202	91	18	6	.....	214	67	5	.....	.....
85	[A]29,840	444	420	6.16	28.70	640	294	300	300	20	[D]45	[D]31	.....	.....	5	[D]11	[D]6	.....	.....	1
86	24,520	828	650	4.60	38.09	464	246	.....	.....	.....	[D]863	[D]737	.....	.....	.....	[D]317	[D]221	.....	.....	.....
87	[A]22,820	656	570	5.72	36.72	307	289	1,023	728	34	261	161	29	28	17	105	50	2	.....	1
88	[A]21,324	600	541	5.48	32.77	292	60	1,178	823	38	236	173	34	15	5	56	23	.....	.....	1
89	19,173	716	683	5.18	37.06	653	538	.....	.....	.....	94	99	.....	.....	.....	8	13	.....	.....	.....
90	18,518	626	575	5.81	36.40	905	1,270	299	293	38	[D]231	[D]278	8	5	16	2	7	.....	.....	.....
91	17,759	848	760	4.38	36.72	273	258	725	470	39	[D]191	[D]437	8	6	18	[D]184	[D]258	.....	.....	10
92	16,879	532	524	6.31	33.33	100	90	740	581	31	65	52	11	32	12	12	5	.....	1	1
93	[A]14,995	508	464	6.30	32.40	181	128	281	391	29	80	82	3	3	9	21	25	1	.....	2
94	[A]11,012	729	624	5.10	36.98	341	532	899	715	53	46	39	.....	.....	5	11	21	.....	.....	2
95	[A]7,647	528	493	4.50	31.95	106	70	130	100	30	5	1	8	3	.....	.....	.....	.....	.....	.....
96	[A]5,443	535	477	6.04	32.33	64	22	40	60	35	2	2	.....	.....	1	1	.....	.....	.....	.....
97	[A]3,342	768	667	4.92	37.85	30	6	250	250	42	62	71	.....	.....	10	12	5	.....	.....	.....
Total	1,559,012	[C]684	[C]620	[C]5.23	[C]35.54	17,885	17,785	83,798	75,171	[C]36	7,954	7,349	2,650	1,202	[C]8	3,712	3,517	613	287	[C]2
IV—WESTERN—West of Rocky Mountains																				
98	[A]576,118	799	750	3.98	31.85	.....	.....	26,056	20,060	30	2,006	1,414	1,112	705	8	1,365	1,124	459	252	4
99	[A]125,618	1,102	1,030	2.82	31.12	875	458	4,939	4,418	20	2,376	1,686	517	370	23	1,136	1,057	243	311	9
100	[A]102,986	558	522	5.80	32.41	1,519	842	.....	.....	.....	250	162	.....	.....	.....	19	2	.....	.....	.....
101	97,204	1,105	1,007	2.95	32.59	491	507	2,750	2,500	30	784	748	885	565	23	732	419	20	.....	6
102	94,226	807	735	4.50	36.54	1,218	1,003	5,777	3,343	40	1,344	808	752	247	30	635	219	31	8	2
103	[A]77,284	1,063	979	3.64	38.75	438	606	6,292	4,764	55	.....	.....	904	809	14	.....	.....	450	375	8
104	[A]64,947	692	613	4.44	30.70	171	120	3,836	2,555	47	199	123	86	26	.....	269	206	61	33	.....
105	[A]59,740	752	718	4.58	34.46	778	822	.....	.....	.....	433	167	.....	.....	20	19	8	.....	.....	.....
106	53,550	1,733	1,635	2.26	39.24	250	366	3,504	3,364	.....	695	515	280	214	31	590	565	79	49	.....
107	41,038	1,408	1,327	3.30	38.53	398	459	3,503	3,248	.....	1,187	947	1,425	609	46	1,358	607	140	.....	16
108	37,987	1,036	923	3.70	38.26	621	676	.....	.....	.....	827	619	.....	.....	.....	236	169	.....	.....	.....
109	37,848	1,342	1,246	2.92	39.18	402	337	3,242	2,222	25	450	512	260	314	18	436	438	100	117	12
110	21,718	1,774	1,692	2.57	45.46	402	403	.....	.....	.....	1,171	759	.....	.....	.....	349	207	.....	.....	.....
111	20,885	650	599	4.96	35.34	308	229	600	500	21	[D]174	[D]83	20	12	19	118	31	.....	.....	4
Total	1,411,149	[C]1,059	[C]984	[C]3.74	[C]36.03	7,871	6,828	60,499	46,974	[C]33	11,896	8,543	6,241	3,871	[C]23	7,262	5,052	1,583	1,145	[C]7
Grand Total	11,793,309	[C]741	[C]672	[C]4.95	[C]35.26	119,808	102,617	346,183	270,616	[C]36	61,840	48,841	21,807	12,353	[C]11	25,917	21,035	4,964	3,508	[C]4

[A]Operate some gas service also. [B]Weighted average. [C]Straight-line average. [D]Includes rentals see Table IV. [E]Discontinued selling. [F]Electric and gas. [G]Major appliances only. [H]Included with all other appliances. [I]All advertising. [J]From company and dealer sales.

Table II—Regional Summary and Comparison of Sales

Some general reflections of local conditions and the sales activity of the power companies in the four major areas of the country

Region	Total Domestic Consumers June 30 1936	Av. Dom. Kw.-Hr. Consumption 1936	Kw.-Hr. Increase Over June, 1935	Av. Cost of Dom. Service Cents 1936	Av. Revenue per Consumer 1936	Refrigerator Units Sold by Power Cos. 1936	Ranges Units Sold by Power Cos. 1936	Water Heaters Units Sold by Power Cos. 1936	Clothes Washers Units Sold by Power Cos. 1936	Ironing Machines Units Sold by Power Cos. 1936	Vacuum Cleaners Units Sold by Power Cos. 1936	Refrigerators Sold per 1,000 Consumers 1936	Ranges Sold per 1,000 Consumers 1936	Water Heaters Sold per 1,000 Consumers 1936	Clothes Washers Sold per 1,000 Consumers 1936
Northeast	7,782,051	650	56	$5.26	$33.72	68,715	29,342	8,429	28,925	6,557	23,216	9	4	1	4
Southeast	1,041,097	834	112	4.69	38.19	25,337	12,648	6,514	2,644	468	1,962	24	12	6	3
Central	1,559,012	684	64	5.23	35.54	17,885	7,954	3,712	4,987	974	4,147	7	5	2	3
Western	1,411,149	1,059	75	3.74	36.03	7,871	11,896	7,262	2,372	625	1,911	6	8	5	2
Nat'l Total or Average	11,793,309	741	169	$4.95	$35.26	119,808	61,840	25,917	38,928	8,624	31,236	10	5	2	3

nd Local Dealers for the First Half of this Year

Clothes Washers Units Sold By Power Cos.		Saturation Clothes Washers Percent	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines Percent	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners Percent	All Other Appliances Units Sold By Power Cos.		Total Sales of All Appliances By Power Cos.		Power Co. Appl. Sales Per Consumer	Annual Revenue Increase from Power Co. Sales	Number Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Advertising Expenditure		Advertising Per Consumer	Company
1936	1935	1936	1936	1935	1936	1936	1935	1936	1936	1935	1936	1935	1936	1936	1936	1935	1936	1936	1935	1936	
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																					
388	466	70	92	104	11	959	763	70	7,740	6,274	$842,620	$1,017,146	$2.72	$161,650	125	110	2,481	$33,183	$34,727	$0.11	69
															89	125	2,852	83,459	70,773	0.33	70
454	532		222	512		248	107		14,849	13,398	399,679	345,493	4.15		82	82	1,174	47,739	72,638		71
14	12	10				222	247	40	K7,100	K5,475	243,600	211,000	2.61	22,360	26	25	3,592	38,500	26,700	0.41	72
248	308		13	20		129	156		17,700	12,033	223,921	213,059	2.86	91,577	53	54	1,478	38,529	29,962	0.49	73
1																					
				4		39	34		6,586	4,854	62,703	47,369	0.97	15,246	10	10	6,480	27,970	23,493	0.43	74
138	184		39	39		434	498				150,936	139,755	2.56								75
115	64	55	27	33	4	26	20	67	752	891	76,728	54,476	1.36	14,511	18	10	3,137	17,457	16,624	0.31	76
452	230		75	8		146	100				265,786	237,946	5.41	36,924	26	34	1,891	3,634	5,500	0.07	77
745	319	60	78	43		400	387	60	1,288	946	303,518	193,818	6.19		50	35	980	34,000	28,000	0.69	78
138	126		3	2		68	66		5,706	5,002	289,366	226,721	6.18	149,507	37	30	1,265	17,489	15,801	0.37	79
365	300		111	45							349,682	297,058	8.40	55,784	68	58	612	21,084	25,366	0.51	80
92	62		4			67	70		3,943	4,482	380,233	318,265	9.72	55,000	43	35	909	12,806	14,455	0.33	81
127	71	48	20	8		222	115	48	3,421	1,478	179,999	88,506	4.70	50,800	50	29	766	10,000	9,242	0.26	82
167	144	65	62	66	12	363	100	60	1,837	1,341	121,171	84,610	3.25	62,604	51	22	731	21,164	25,640	0.57	83
423	254		53			78	100		5,844	3,070	406,300	541,199	12.51	85,225	57	52	570				84
218	150	38	18	13	1	200	150				152,410	122,540	5.11		36	27	829	7,200	5,400	0.24	85
56	27		24	12		20	15		546	883	161,453	106,383	6.58		9	11	2,724	2,146	1,875	0.09	86
85	141		23	19		88			687		L121,323	L101,514	5.32	19,307	33	24	692				87
107	163		24	73							L123,603	L61,122	5.79	39,838	18	11	1,185	639	1,134	0.03	88
88	112		8	6		149	116		840	660	182,880	132,015	9.54		18	16	1,065	2,848	2,239	0.15	89
198	170		9	7		76	70		1,000	950	165,098	205,513	8.92	52,000	M	M		5,662	7,593	0.31	90
20	20		1	1		50	43		1,526	1,484	61,611	66,164	3.47	27,500	12	12	1,480	9,950	8,768	0.56	91
152	74		43	20	4						46,229	32,800	2.74	5,947	15	10	1,125	4,425	3,487	0.26	92
114	127	40	18	21	1	46	74	35			53,615	41,290	3.58	10,555	8	12	1,874	2,684	3,097	0.18	93
				1	1	10	20	15	1,500	1,200	107,254	103,774	9.74	30,000	14	13	787	3,553	3,312	0.32	94
53	25	70	3	5	5	50	40	85	60	50	36,146	28,458	4.73		8	8	956	2,234	1,897	0.29	95
49	54	75	4	4	10	57	63	60	561	352	25,668	19,202	4.72	1,900	6	6	907	1,035	813	0.19	96
											16,185	14,622	4.84		3	3	1,114				97
4,987	4,135	C53	974	1,066	C5	4,147	3,354	C60	83,486	64,823	5,549,717	5,051,818	B3.56	988,235	965	864	B1,555	449,360	438,536	C0.31	Total
IV—WESTERN—West of Rocky Mountains																					
		50			6			60			345,000	299,040	5.99	118,893				92,672	92,277	0.16	98
									1,988		586,386	391,628	4.67	171,614	70	80	1,794	30,000	40,000	0.24	99
398	369		113	85		557	618		10,107	4,569	479,645	328,964	4.66		80	66	1,287	41,891	40,771	0.41	100
144	192	48	44	38		86	82	50	3,818	2,538	342,024	306,753	3.52	69,345	63	43	1,543	36,462	24,755	0.38	101
311	190	75	66	50	2	273	391	75	12,128	655	514,255	385,664	5.46	90,540	129	79	730	60,150	37,500	0.64	102
95	183	75	30	32	4	42	101	80	2,157	3,509	146,950	131,105	1.90	90,075	37	37	2,089	6,913	3,577	0.09	103
139	136		39	58		130	108		6,216	3,520	148,584	99,327	2.29		25	22	2,598	15,304	16,852	0.24	104
134	273		H	56		305	285		69,196	74,526	321,247	301,916	5.38	50,000	70	60	853	7,506	16,000	0.13	105
231	233		H	H		219	266		4,943	5,407	230,569	213,694	4.31	113,265	27	28	1,983	43,198	34,819	0.81	106
317	491		136	109		77	185		1,565	1,432	339,613	268,156	8.28	77,785	61	56	673	15,107	9,964	0.37	107
											243,842	236,458	6.42		32	30	1,187	4,566	4,385	0.12	108
342	379	45	182	131	10	72	78	30	3,192	3,182	206,222	211,436	5.45	42,525	57	49	664	15,842	18,516	0.42	109
											234,091	171,174	10.78		27	25	804	5,941	4,991	0.27	110
61	75		15	20		150	118		1,551	1,104	104,972	75,610	5.03	26,000	15	14	1,392	1,981	1,653	0.09	111
2,372	2,521	C59	625	579	C5	1,911	2,232	C59	116,861	100,442	4,243,400	3,420,925	B3.01	850,042	693	589	B1,205	377,527	346,060	C0.31	Total
28,928	34,742	C54	8,624	7,336	C6	31,236	26,086	C62	517,026	433,202	41,355,673	33,905,765	B3.58	6,465,245	6,748	4,925	B1,654	2,343,656	2,172,679	C0.27	Grand Total

AIncl. portable lamps and lighting fixtures. LAll classes of consumers. MAll employees act as salesmen. NIncludes E.A.R. from dealer refrigerator sales. OAs of December 1935. PAs of December 31, 1934. QDoes not include sales people in 33 stores. SIncluded $71,000 spent for institutional series. TDo not merchandise.

ales Totals, Saturations and Averages

Relating roughly the prevailing cost of using appliances, their present popularity and the scale on which they are being sold

oning chines old per ,000 Con- sumers, 1936	Vacuum Cleaners Sold per 1,000 Consumers, 1936	Av. Saturation Refrigerators 1936 %	Average Saturation Ranges 1936 %	Average Saturation Water Heaters 1936 %	Average Saturation Clothes Washers 1936 %	Average Saturation Ironing Machines 1936 %	Average Saturation Vacuum Cleaners 1936 %	Total Appliance Sales 1936	Appliance Sales per Consumer 1936	Total Annual Revenue Increase 1936	Total Sales People on Domestic Load 1936	Consumers per Sales Person 1936	Total Adv. Expenditure 1936	Advertising per Consumer, 1936	Region
1	3	32	7	2	61	7	69	$24,196,372	$3.11	$3,716,255	4,106	1,895	$1,238,216	$.19	Northeast
0	2	44	12	5	23	2	33	7,366,184	7.08	910,713	984	1,058	278,553	.40	Southeast
1	3	36	8	2	53	5	60	5,549,717	3.56	988,235	965	1,555	449,360	.31	Central
0	1	33	23	7	59	5	59	4,243,400	3.01	850,042	693	1,205	377,527	.31	Western
1	3	36	11	4	54	6	62	41,355,673	3.58	6,465,245	6,748	1,654	2,343,656	.27	Total

According to these estimates dealers have sold 28 per cent more refrigerators, 77 per cent more ranges, 46 per cent more water heaters, 19 per cent more clothes washers, 31 per cent more ironing machines, 13 per cent more vacuum cleaners and 28 per cent more of all other appliances than in the same period last year.

The dealers showed even better gains than the power companies and made outstanding progress in marketing ranges and water heaters. The utilities today are the major outlets only for ranges and water heaters. Based on these estimates, the power companies now sell 21 per cent of the refrigerators, 69 per cent of the ranges, 82 per cent of the water heaters, 12 per cent of the clothes washers, 26 per cent of the ironing machines, 13 per cent of the vacuum cleaners and 18 per cent of all other appliances. This means that the dealers have generally improved their position, for in ELECTRICAL WORLD's survey of appliance sales for the full year of 1935, the dealers were estimated as selling 76 per cent of the refrigerators, 25 per cent of the ranges and 16 per cent of the clothes washers. These percentages now stand 79, 31 and 18 respectively and the proportion of ironing machine, vacuum cleaner and miscellaneous sales is also stepped up, as shown in Table IV.

Only 78 of the 111 power companies could report figures on the estimated annual revenue expected from their appliance sales for the first six months of this year. Only 72 reported for both half years and their total is $5,657,312 for 1936, as against $5,199,742 for the first half of 1935. This shows a gain in E.A.R. of 9 per cent.

When it comes to the position of the individual companies, in terms of average annual domestic consumption, average revenue per consumer and average cost of service to the home, the same wide divergence obtains that the previous surveys have shown. The highest average annual domestic consumption figures, of course, come from the Pacific Coast, where the tops are 1,774, 1,733, 1,408 and 1,342 kw.-hr. But the Southeast is also climbing high with 1,113, 1,059, 1,048 and 997. The highest averages in the rest of the country run in the 800's. The Northeast reports 829, 816, 809 and others in that neighborhood, the Central area 896, 848, 828 and so on. But there are still a lot of low averages dragging along—with bottoms of 418 in the Northeast, 546 in the Southeast, 444 in the Central area and 558 on the Coast.

Six Months of Sales

111 Power Companies Serving 11,793,309 Domestic Consumers

	Per Cent
Increased merchandise sales	22
Increased average annual consumption	10
Increased sales personnel	37
Increased advertising expenditures	8

They sold:
17 per cent more refrigerators
27 per cent more ranges
23 per cent more water heaters
12 per cent more clothes washers
18 per cent more ironing machines
20 per cent more vacuum cleaners
19 per cent more other appliances

Pacific Coast power companies report:
—lowest average annual domestic consumption
—highest average domestic rate
—highest range saturation
—highest water heater saturation

Southeastern power companies report:
—largest gains in average consumption
—largest appliance sales per consumer
—largest revenue per consumer
—largest advertising expenditure per consumer
—lowest number of consumers per sales person
—largest sales of refrigerators, ranges and water heaters per 1,000 consumers
—highest refrigeration saturation

Outstanding Gains

There are some notable increases in annual domestic consumption averages, by the way. The best are all in the Southeast, where companies show gains of 212, 209, 184, 182 and 171 kw.-hr. The Northeast also presents 102, 100, 97 and 96, the Central area 178, two at 108 and 105, and the Far West 113, 98 and 96. This is good going. The total improvement in average annual domestic consumption on June 30, 1936, over the year before was 10 per cent.

Average appliance sales per consumer are running higher this year than last. For the first half of 1935 the high was $13.65 and this year a Southeastern company leads with $16.75 and other utilities in that section have $13.15 and $12.25. The top in the Northeast is $13.40, with Central $12.51 and Western $10.78. The lows go too far down to list—as low as $0.38 in the Northeast, $2.27 in the Southeast, $0.97 in the Central area and $1.90 on the Coast.

Average rates range from 7.70 to 3.43 cents per kilowatt-hour in the Northeast, from 6.04 to 3.42 in the Southeast, from 6.36 to 3.31 in the Central area and from 5.80 to 2.26 cents on the Coast. But rates do not appear to have much bearing on sales volume, in this tabulation.

The average revenue per consumer presents the same variance. The tops are $56.33 in the Southeast, $45.46 in far West, $43.40 in the Central area and $44.83 in the Northeast. In the Northeast 21 companies reported gains and 27 losses in average revenue per domestic consumer. In the Southeast fifteen reported gains and four losses, in the Central area twenty reported gains and seven losses and in the far West there were ten gains and four losses. The losses probably, in all these cases were due to rate reductions.

A large increase shows up in the number of sales men and women employed by these companies in building domestic load. The average in the first half of 1936 was 6,748 and it was 4,925 for the same period of 1935. This was an increase of 1,823, or 37 per cent. One company jumped from 100 to 140, another from 79 to 129, another from 21 to 65, another from 20 to 57 and increases of this kind denote sweeping changes in load building policy.

There remains, however, an amazing difference in the local concept of the number of customers a salesman can cover. In one city they employ one sales person per 8,625 domestic consumers; in another, one for 7,947, and in another, one for 7,253 consumers. But three Southeastern companies are staffed so that they show a coverage of 460, 567 and 594 con-

sumers per sales person. The best records in the Northeast are 530 and 578, in the Central area 570 and on the Coast 664. This shows distinct improvement, for a year ago one company reported 23,276 consumers per salesman and another 10,750, while the lowest figure was 590. The utilities are putting on more personnel.

They are also doing more advertising to build domestic load; for these companies spent $2,343,656 in the first half of this year, as against $2,172,679 in the same period of 1935. But this increase of 8 per cent is small against the 37 per cent gain in sales personnel, and it would appear that advertising is not being increased in balance with man-power. The highest expenditures for advertising per domestic consumer were 88, 75 and 63 cents in the Southeast, 81 and 64 on the Coast, 69 and 57 in the Central area and 46 and 45 cents in the Northeast. Some of the companies spend no more than 4, 5 or 7 cents per consumer, and of this the less said the better.

As a result of it all, saturation has been building up, though many companies have no data on it. Of the 111 companies only 80 companies knew their saturation on refrigerators, 76 on ranges, 55 on water heaters, 34 on clothes washers, 29 on ironing machines and 32 on vacuum cleaners. Based on these reports, the total average saturations figured—refrigerators 36 per cent, ranges 11 per cent, water heaters 4 per cent, clothes washers 54 per cent, ironing machines 6 per cent and vacuum cleaners 62 per cent. The highest estimate for refrigeration is 57 per cent in the Southeast, the highest on ranges is 46 per cent on the Pacific Coast, the highest on water heaters 16 per cent in the far West, the highest on clothes washers 87 per cent in the Northeast, the highest on ironing machines 16 per cent in the Northeast, the highest on vacuum cleaners 89 per cent in the Northeast. The national saturation figures published by the several manufacturers' associations that report statistics give the following: Refrigerators 34.2 per cent, ranges 6.8 per cent, clothes washers 48.8 per cent, ironing machines 4.9 per cent and vacuum cleaners (floor type) 48.3 per cent. This makes an interesting comparison with the estimates of these power companies.

Small appliances are also being pushed because they make friends

The regional aspect of these reports from the 111 utilities that sell appliances shows up some striking generalizations. The Pacific Coast has the highest average annual domestic consumption and the lowest average rate. The Southeast, with next to the lowest rate, has the largest gain in average consumption, the largest appliance sales per consumer, the largest revenue per consumer, the highest advertising expenditure per consumer and the lowest number of consumers per sales per-

Table III—Load Building Where the Power Company Sells No Appliances

Consumption, growth of load, average rates, revenue and number of salespeople and advertising expenditure per consumer, together with power company estimates of dealer sales and saturations of refrigerators, ranges and water heaters

Company	Total Domestic Consumers		Av. Annual Domestic Consumption		Av. Annual Dom. Revenue	Av. Rate Dom. Service —Cents	Refrigerators Units Sold By Dealers	Saturation of Refrigerators	Ranges Sold By Dealers	Saturation of Ranges	Water Heaters Sold By Dealers	Saturation of Water Heaters	Personnel on Load Building		Advertising Expenditures		Advertising per Consumer
	1936	1935	1935	1935	1936	1936	1936	1936	1936	1936	1936	1936	1936	1935	1936	1935	1936
1	[A]701,331	671,348	457	425	$27.51	6.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	648,636	638,048	510	486	29.90	5.86	.....	.....	.....	.....	.....	.....	107	62	.....	.....	.....
3	[A]591,858	575,336	[C]805	[C]748	32.25	4.01	25,778	.....	[E]5,313	.....	[F]329	.....	294	274	83,378	122,238	$0.14
4	387,799	372,700	775	714	31.93	4.12	22,354	44	3,451	8	1,584	3	160	110	80,000	75,000	0.21
5	304,201	296,879	581	552	33.10	5.78	4,040	.....	134	.....	.....	.....	24	21	.....	.....	.....
6	146,544	140,734	1,043	979	34.05	3.27	[G]9,656	.....	[G]862	.....	[G]36	.....	21	16	.....	.....	.....
7	[A]116,081	112,611	640	575	40.83	6.38	[H]2,644	.....	[H]47	.....	.....	.....	4	4	.....	.....	.....
8	99,695	93,640	658	625	38.12	5.71	8,915	50	43	2	.....	.....	12	10	20,000	30,000	0.20
9	[A]81,646	78,795	[BC]633	[BC]593	33.25	5.25	4,786	.....	8	.....	1	.....	21	16	14,338	10,184	0.18
10	[A]78,423	76,419	696	646	29.46	4.22	5,000	.....	35	.....	15	.....	1	1	.....	[A]4,017	.....
11	74,078	73,105	706	660	35.50	5.03	3,624	36	565	10	.....	.....	36	20	14,221	10,427	0.19
12	59,858	58,695	[BC]1,038	[BC]909	39.16	3.77	4,292	43	833	15	.....	.....	31	30	30,000	25,000	0.50
13	[A]58,978	57,000	530	488	34.75	6.56	3,040	27	270	3	51	.....	55	55	7,447	3,613	0.13
14	[A]58,850	56,406	[B]789	722	41.26	5.23	2,140	.....	751	.....	120	.....	.....	.....	10,000	10,000	0.17
15	[A]52,478	50,457	548	510	26.44	4.82	2,115	36	30	2	11	1	.....	.....	9,950	8,891	0.19
16	[A]50,284	48,633	695	662	37.33	5.37	3,840	.....	133	.....	8	.....	10	9	10,183	11,585	0.20
17	27,744	26,958	1,246	1,189	35.99	2.89	2,396	.....	746	.....	160	.....	19	16	18,908	17,372	0.68
18	[A]27,049	26,047	[B]645	[B]607	28.89	4.55	2,466	38	.....	.....	.....	.....	.....	.....	4,880	4,844	0.18
19	[A]17,918	17,854	[B]616	[B]556	29.80	4.90	1,523	41	1	.....	2	.....	3	3	11,900	11,700	0.66
20	[A]9,798	8,933	777	731	44.36	5.70	839	65	45	20	15	10	2	2	4,514	3,249	0.46
21	[A]9,452	9,155	1,113	954	45.17	4.11	678	49	405	44	96	10	1	1	4,000	2,600	0.42
Total..	3,602,701	3,489,803	[D]738	[D]682	[D]34.72	[D]4.93	110,126	[D]43	13,672	[D]13	2,428	[D]6	801	650	323,719	360,720	[D]0.30

[A]Operate some gas service also. [B]Rent ranges. [C]Rent water heaters. [D]Straight line average. [E]Includes 1,457 sold by company. [F]Includes 199 sold by company. [G]Covers first 5 months. [H]Covers May and June only.

Table IV
Who Sells the Appliances

Proportion of the major appliances sold by power companies and local dealers, as estimated, in units, by the reporting companies.

Appliances	Power Company Sales Per Cent	Dealer Sales Per Cent
Refrigerators	21	79
Ranges	69	31
Water heaters	82	18
Clothes washers	12	88
Ironing machines	26	74
Vacuum cleaners	13	87
Miscellaneous appliances	18	82

son. The Southeast also leads in the sales of refrigerators, ranges and water heaters per 1,000 consumers and, as a region, stands first in refrigerator saturation and second in the saturation of ranges and water heaters.

Perhaps the most interesting reflections in the entire study will be found in comparing the reports of the 21 companies that do not merchandise (Table III) with the results that have been gained by the companies that sell appliances. The non-merchandising companies show a gain of 3 per cent in total domestic consumers, against 4 per cent for the other group in Table I. They show a total gain of 8 per cent in average annual domestic consumption, with highs of 1,246 and 1,113, in the far West and 1,043 and 1,038 in the Northeast. The lows are 457, 510 and 530. Their largest increases in average consumption were 159 and 129 kw.-hr., which were jumps of 16 and 14 per cent.

For average domestic revenue, these non-merchandising companies show a small gain from $34.38 in 1935 to $34.72 in the first half of this year, with highs of $45.17, $44.36 and $41.26. Their average cost of service runs from highs of 6.02 and 5.86 cents down to 2.89 and 3.27 cents. Their total personnel engaged in load building increased from 650 in 1935 to 801 this year, a jump of 23 per cent. And all these figures compare favorably with companies that sell appliances.

Advertising lags

In advertising expenditure, however, the fifteen companies that reported for both years fell off from $346,703 for the first half of 1935 to $323,719 in the same period this year, showing a decrease of 7 per cent. But the ratio of advertising per consumer ran from highs of 68, 66, and 50 to lows of 13, 14 and 17 cents, neither as good or as bad as the record of the large group.

These non-merchandising companies seem to know little more about what their dealers are selling than the other group, when you go beyond refrigerators, ranges and water heaters. Of the 21 companies, eleven estimated on clothes washers, twelve on ironing machines, nine on vacuum cleaners and seven on miscellaneous appliances. They reported local saturation for refrigerators at 43 per cent, ranges 13 per cent, water heaters 6 per cent, but only four would hazard a guess on laundry equipment and three as to the number of cleaners on their line.

The rental of ranges, water heaters and small refrigerators, by both merchandising and non-merchandising companies, continues, but on a smaller scale. In the first half of 1935, 21 of these companies rented 6,931 ranges, but this year twenty companies rented 5,654 ranges. Last year eighteen companies rented 4,537 water heaters and this year 19 companies rented 4,308. Last year five companies rented 1,698 small refrigerators and this year three companies rented 1,764. These totals are embraced in the total sales listed in the tabulation and are indicated by footnotes in Tables I and III and by Table V.

Of the 132 companies, 78 provide gas service to a total of 3,372,505 domestic consumers. Four other combination companies do not report their number of gas customers. Those that sell gas are indicated by footnote.

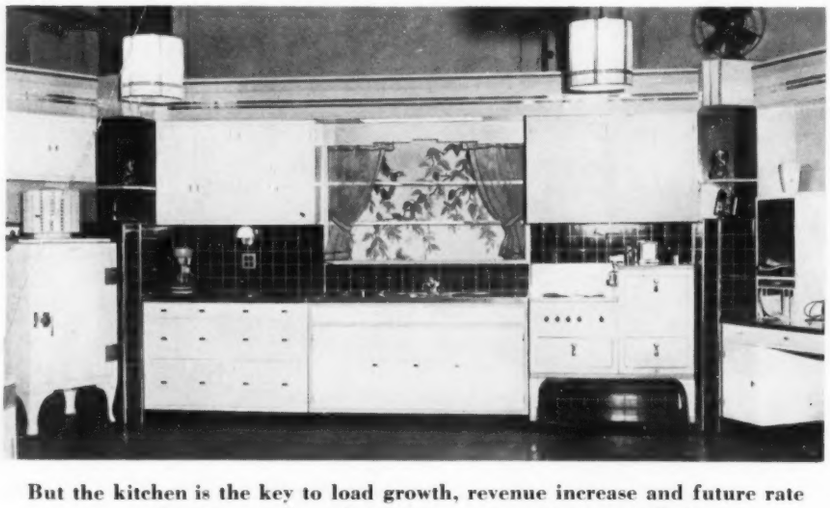
All these figures are presented as reported and without any attempt to allow for the influence of local conditions or company policies or to draw conclusions. Saturations, rates and sales records reflect much of this background, however, and the data are susceptible to considerable further analysis. The tables tell their own story and are submitted for use in individual company comparisons.

Table V
Trends in Renting Appliances

Number of reporting companies which were renting ranges, water heaters and small refrigerators during the first half of this year and last.

Company	Ranges Rented		Water Heaters Rented		Refrigerators Rented	
	1936	1935	1936	1935	1936	1935
4	1,595	1,509	2,066	1,304	....	.....
12	377	407	....	....	....	.....
13	....	....	144	....	....	.....
17	....	....	55	24	....	.....
24	....	50	....	....	....	.....
32	184	.....	57	....	....	.....
33	....	....	65	55	....	.....
34	....	....	....	....	.....	99
39	358	478	31	48	....	168
50	71	121	26	21	1,739	448
52	....	1,348	87	1,362	.....	959
53	20	78	59	65	.....	.....
54	1	12	....	7	.....	.....
64	....	10	1	12	.....	.....
65	50	53	26	6	24	24
71	692	481	304	231	....	.....
82	127	161	167	285	1	.....
85	15	14	8	2	....	.....
86	339	390	177	130	.....	.....
90	*5	133	....	....	....	.....
91	139	268	171	185	....	.....
111	6	5	....	....	....	.....
Rentals by companites that sell no appliances						
3	....	....	749	600	....	.....
9	340	169	54	21	....	.....
12	909	1,138	161	179	....	.....
14	385	....	....	....	....	.....
18	40	46	....	....	....	.....
19	1	10	....	....	....	.....
Total	5,654	6,931	4,308	4,537	1,764	1,698

*No longer renting ranges.



But the kitchen is the key to load growth, revenue increase and future rate reductions, so here the industry concentrates its effort

Scroll Case Designed on Visualized Hydraulics

Greatly Improved Hydraulic Efficiency Results—Bonneville Designs Obtained From Model Experimentation Permitting Slow Motion-Picture Studies of Flow in Intake, Scroll Case and Distributor Ring

By HOWARD L. COOPER

Associate Engineer, U. S. Engineer Department, Bonneville Project, Portland, Ore.

This is the first of two articles by the author describing the valuable data on scroll case and draft tube design for large hydro-electric reaction turbine units. Details on the draft tube studies will be presented in a second article in a forthcoming issue.

TO INVESTIGATE the disturbances within hydraulic machinery and structures the U. S. Army engineers have developed a new technique for hydraulic study which has resulted in the determination of more efficient designs for the scroll case and draft tube of large reaction turbines. The work was undertaken in connection with the development of the Bonneville power project, located 42 miles east of Portland, Ore.

Results and data hereinafter described indicate the very real need for model experimentation in order to obtain engineering facts for the preparation of hydraulic designs. With this short paper it is impossible to describe all the various phases and interesting results obtained. However, an attempt will be made to point out the more important items of interest and how the results were calculated.

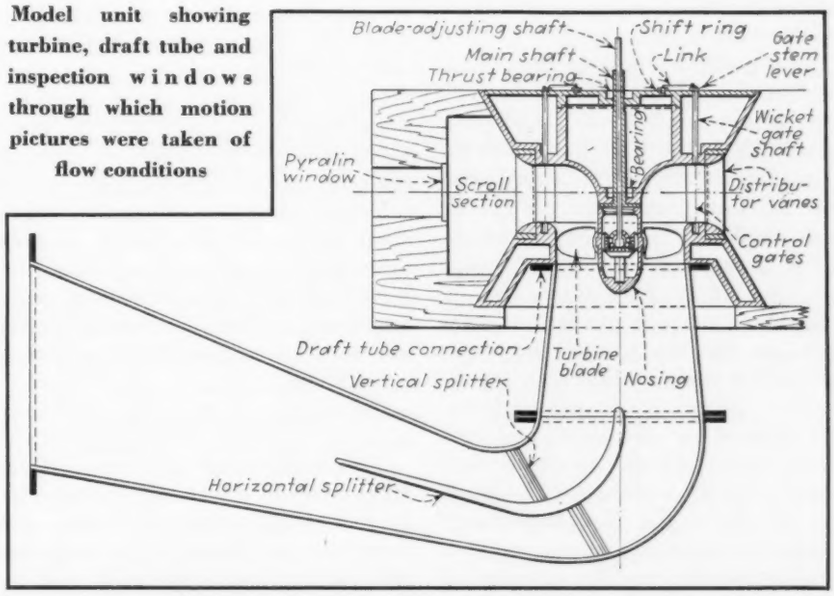
Many engineers and manufacturers are aware of the fact that improved methods are being used in the laboratory challenging the very existence of the hydraulic industry.

In the laboratory of the Second District, U.S.E.D., Portland, Ore., were installed two flumes, one for draft tube studies, the other for the complete model power unit including the turbine, scroll case, turbine intake and draft tube.

The two 60,000-hp. main units to be installed in the Bonneville power house are of the single-runner, vertical-shaft type for installation in concrete scroll cases and of the adjustable-blade, propeller type. The runner blade and control gates operate automatically upon any change of speed due to variable head or load conditions. They will operate in a clockwise direction at a speed of 75 r.p.m. and deliver to the generator shaft 60,000 hp. at an effective head of 50 ft. Gate limits shall be provided which will limit the horsepower output to 66,000 hp. when operating at a head higher than 50 ft., this being the limit of the generating capacity. The propeller type adjustable-blade runner will have five blades which rotate on a 26½ in. shank through approximately 26 deg. These blades will be protected against cavitation by building up the periphery and portions of the surface with 18 per cent chromium and 8 per cent nickel from ¼ in. to ½ in. thick. The No. 1 unit will have the runner blades machined to true designed curves. Each turbine will have one guide bearing for supporting the lower end of the 39-in. diameter shaft.

Governing equipment for the two units, including the actuator valves, pumps, sump tank, relays and motor-driven speed responsive element, will be installed in one totally inclosed cabinet located on the operating floor between the generators.

The scroll case and draft tube models were made to a ratio of 1 to



Model unit showing turbine, draft tube and inspection windows through which motion pictures were taken of flow conditions

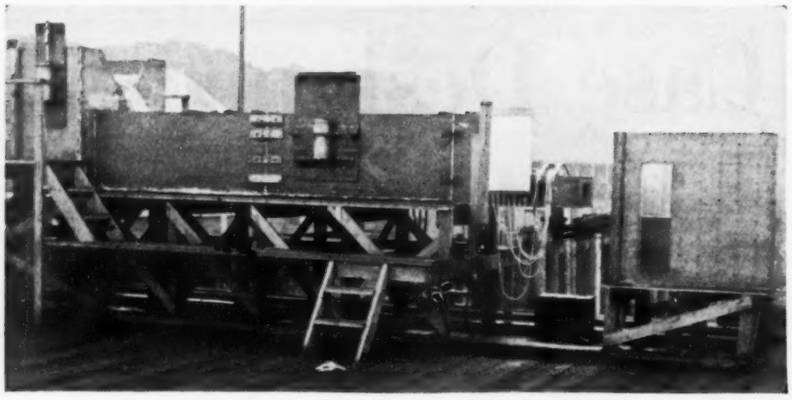
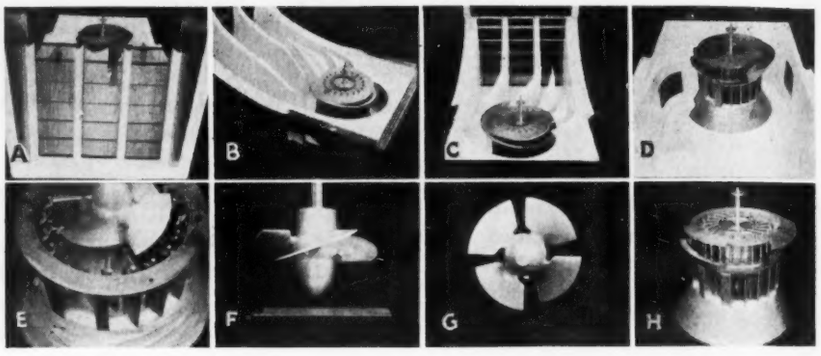


Fig. 2—General view of the model laboratory installation

(A) Model turbine looking downstream from behind trashrack, (B) scroll case showing "islands" in far channel, (C) model looking upstream showing scroll case design, (D) scroll case showing apertures through which hydraulic flow was observed, (E) close-up of turbine wheel and distributor ring, (F) and (G) two views of model Kaplan runner and (H) model turbine assembly.



46.6, this particular ratio being used so that the model runner could be made 6 in. in diameter. The scroll model was made of a white pine lining inside of a five-ply veneer box, the top being covered with $\frac{1}{8}$ in. pyralin. On the three sides of the turbine pyralin windows were installed in the wooden box and conforming to the contours of the scroll. Through these pyralin windows the action of the water was easily observed and photographed.

In order to photograph the actual flow of water through these models it was, of course, necessary to suspend some material of approximately neutral buoyancy in the water. Considerable time and study were spent in the search for a satisfactory material; particles heavier than water would naturally tend to sink and those lighter than water would rise to the surface, both giving the wrong pattern of the flow. The material finally used in all the slow-motion-picture studies was a granular hardwood sawdust which had been allowed to soak in water at least 24 hours. This material could be placed in the intake at any desired elevation and it would track the true flow of the water.

Some earlier attempts to photograph the flow through the top and the windows of the scroll were unsuccessful, partly due to the fact that it was attempted in the daylight and the reflection from the sky, even on cloudy days, made it impossible to photograph through the pyralin. It was then decided to photograph the internal flow at night under artificial light. At first this was not very successful, but with considerable experimenting, including proper lighting, the elimination of glare and the proper setting of the aperture, some very fine results were obtained. In the last 800 ft. of the War Department record slow-motion pictures most of the photographic troubles experienced in the earlier attempts were eliminated and the actual direction of flow could be very easily seen, simplifying the study considerably. Generally speaking, the most successful pictures were made with the distributor, control gates and pedestals in a natural bronze color, while the rest of the inside was painted with white enamel.

In setting up the camera the correct focal length is essential. Three No. 1 photo-floodlights with large reflectors were used to illuminate the interior, this being done, when photographing through the small windows, from the top and the adjacent windows, never through the window in which the pictures were being taken. Extreme care had to be taken that no reflections from the lights could be seen from the camera position. The flow in the draft tubes was photographed by placing the reflectors at various angles behind the tube, being certain that no reflections or bright spots could be seen from the camera position. The film used was 16-mm. supersensitive panchromatic and operated at 64 frames per second in a special camera having an *f*1.9 lens.

Scroll case experiments

Fig. 4 shows the three general designs of scrolls that were tested with various combinations of shapes and velocities. In Series 1, the scroll intake and draft tube were all located on the same center line. This particular design was adopted for the Bonneville project as it simplified the power house structure, it not being necessary to offset the main buttress piers. In order to carry the water to all the gates at the required velocity and angle of approach two islands were used in the "C" channel. Series 2 required only one island in the "C" channel as the center line of the turbine was offset 4 ft. from the center line of the intake and draft tube. Series 3 included a group of tests using no islands, the center line of the turbine being offset 7 ft. from center line of intake and draft tube.

The first experiments conducted with these various scroll cases were the balancing of the flow in the three intake channels. This was accomplished by installing three separate entrance channels to the scroll directly connecting to the A, B and C channels. Into each channel was admitted exactly the same amount of water under the assumption that if each scroll channel carried the same amount the elevation of the water in the entrance channels would be exactly the same elevation and, subsequently, if this entrance level in any particular channel was lower than the others it would indicate that that particular intake had the least hydraulic friction and would carry more water, if all the entrance channels

were at the same level, corresponding to the prototype forebay.

Two baffles were used to take the surges from the approach channels in order to give a smooth flow of water at the entrance of the scroll. To each of the three approach channels was connected a stillwell in which a micrometer hook gage was installed for measuring the level of the water.

The procedure of running an experiment on the balancing of the flow was to record the water level in each of the three intake channels at the same time and reading the gage which gave the exact amount of water that was flowing into each of the channels. Using the actual head in these three entrances measured by the hook gage above the center line of the distributor, corresponding equivalent orifices were calculated and all the heads reduced to one common head. The co-efficients of the equivalent orifices were then used to calculate what the actual flow in each channel would be had the level been the same in all three of the approach channels. The flow in the three intake channels of the scroll design adopted for the Bonneville power project varied only 1½ per cent. The next experiment was to have the flow from any of the various channels meet the adjacent channel at the same velocity. This was checked by photographing in slow motion the small particles which had been placed in the water. Additional checks were made by placing white cotton yarns along the sides of the piers and observing the action at the transition. Uneven velocities would cause a distinct curve or flutter in the yarn.

All of these velocities were checked with an Iowa pitot tube and velocity contours were made to check the average velocities and quantities. When we had developed a design which would divide the water evenly among the three entrance channels, with smooth transitions, we concentrated on the elimination of eddies, vortices and cross currents within the scroll itself. The most serious of these disturbances was the 45-deg. vortex on the lee side of the distributor vanes. This whirl extended at times from the center of the scroll channel through the vanes and into the runner pit. In order to determine the real cause of this disturbance, a 16-mm. motion-picture camera operating at 64 frames a second was used to photograph the flow.

By the aid of the camera many eddies and disturbances that were not visible to the naked eye were discovered. This induced the conclusion that this vortex could be eliminated by changing the design of the distributor vanes. Sixteen complete distributors were built and tested, all having differently shaped vanes and pedestals, before we arrived at a satisfactory design. The variation in the vane design primarily consisted in the alteration of cross-sectional shapes. However, various combinations of inside and outside dimensions were tested. It can be noted in the last 800 ft. of the War Department's record slow-motion pictures where the complete turbine installation and the final distributor design is seen there is no disturbance on the leeside of the vanes or from the top or bottom of the scroll, the water entering in a very smooth flow from all directions.

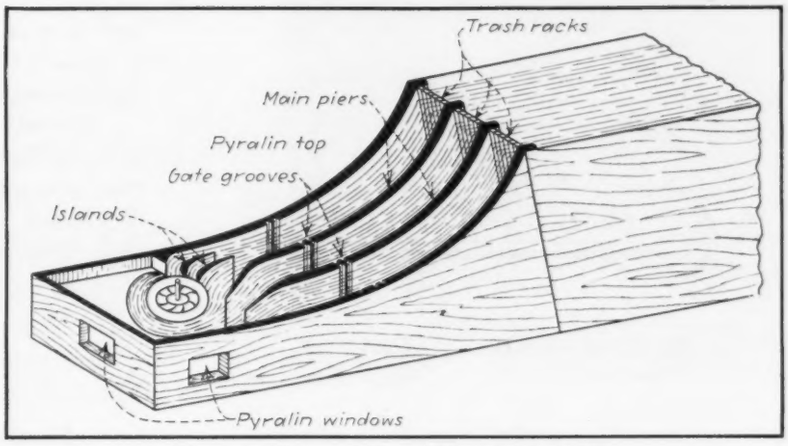


Fig. 3—Cutaway view of the model intake

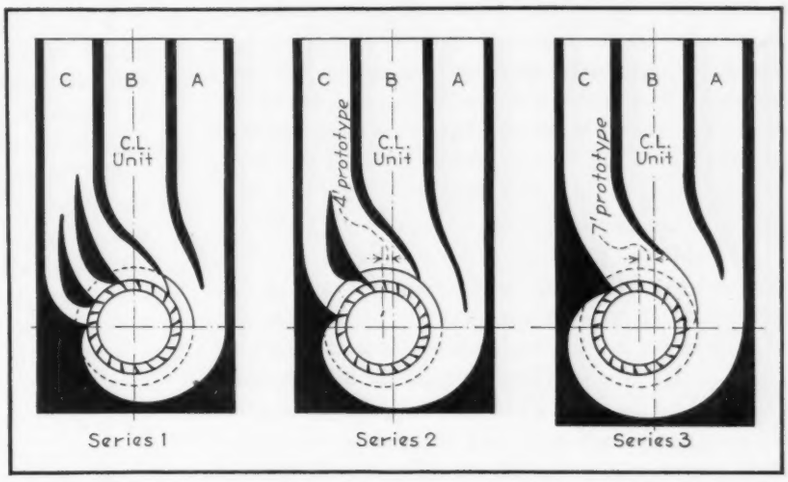


Fig. 4—Experimental scrolls used in study. Series 1 was selected for the Bonneville project because it simplified the power house structure and permitted high hydraulic efficiencies

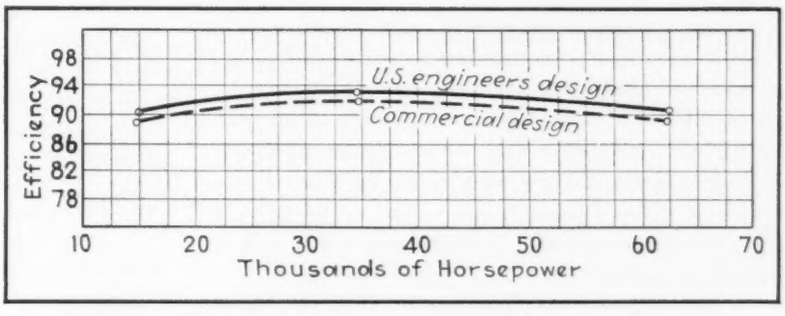


Fig. 5—Efficiency gain made by design changes based upon the model experiments

Fig. 5 shows a comparison between this final design of distributor vanes and the straight commercial type vane, as determined in our laboratory and stepped up by Moody's differential, the remaining parts of the scroll being exactly the same in both tests.

Many other tests were run on these various scroll case models, including gate slots, vortices and head losses, accelerating, decelerating and constant velocities in the scroll and intake and the raising and lowering of the distributor center line.

If our assumptions are correct these scroll case designs practically balance the flow of water in each channel, and as can be seen from the curve in Fig. 5 considerable efficiency is gained by

[*Continued on page 125*]

Editorials

L. W. W. MORROW • EDITOR

But What Does It Cost?

ANOTHER semi-annual survey of power company merchandising, presented in this issue, shows increasing progress in domestic load building. The study embraces three-fourths of the industry, in terms of total consumers served. It shows 22 per cent more merchandise sold than in the first half year of 1935 and 9 per cent more gain in estimated annual revenue from new load, by those utilities that reported for both periods.

In addition to larger sales of the heavy load builders, some interesting new high figures appear. An average annual domestic consumption of 1,774 kw.-hr. and an increase by one company of 212 kw.-hr. in total average over a year previous are both the highest so far reported. An average of $16.75 in appliance sales per consumer in the half year and an average revenue of $56.33 per consumer top all previous records in these surveys. Sales personnel was increased 37 per cent and advertising 8 per cent. Some "lows" still drag the ground, but many of them moved forward appreciably.

A vast amount of experience for comparison with individual company accomplishments is revealed to any one who will study these tabulations. In every case, however, it leads inevitably to the question, "But what does it cost?" We have here the record of appliances sold, load gained and revenues increased, but nobody knows how much expense was involved, at what price the big gains were secured. Yet this measure is vital to the whole study.

In gathering the data from these companies a definite question was asked as to the total cost of adding this new load. Out of the 132 companies listed, 63 reported figures ranging from $0.05 to $5.03. Though answering the same question, they obviously were not speaking of the same thing. They all would be interested to compare their costs with those of other companies, but are prevented because company accounting practice differs. So this survey lacks the vital element of cost.

After all, the only reason for keeping books is to make information available to management and to investors. Why, then, in a period when executive interest is focussed so closely on load development, should the mere lack of accounting uniformity make it impossible to measure the commercial proficiency of one company against another?

It would seem well worth while for the utilities that are contributing their data to these surveys every six months to agree upon some simple method of recording the common cost of domestic load development. Such a method will be suggested and it is hoped that in the next survey the cost of selling also may be compared.

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Speeding Up Calls for Better Balancing

NOT ALL the instrumentation trend in industry has to do with planting meters on production machines or on the feeders that serve groups of them. True enough, designers are interested today in having an indicator which will disclose a dull tool or improper adjustment of feeds so the operator can get the predicted performance for the owner. That safeguards the claims and the prestige of the machine manufacturer. But instrumentation is extending as well into the laboratories of the maker and the user.

Take, just for one example, the trend toward higher speeds. Higher speed demands more refined balancing, and here is where the balancing machine is finding increased opportunity to serve. Some of them are almost human in the way they tell how much a tested part is out of balance and where the eccentricity lies. The extreme range of usefulness of these aids to refined production is rather startling. They tell the answers about the armatures of vacuum cleaner motors, about rayon buckets and about the rotors of the biggest power plant turbines with equal ease. With the curbs on noise, vibration and lost efficiency on the ascendency, it looks as though more producers of rotating equipment would have to discard the measures that are as old as slapping on a lump of putty opposite the heavy side. The by-guess and by-grace technic is yielding to the 1936 way.

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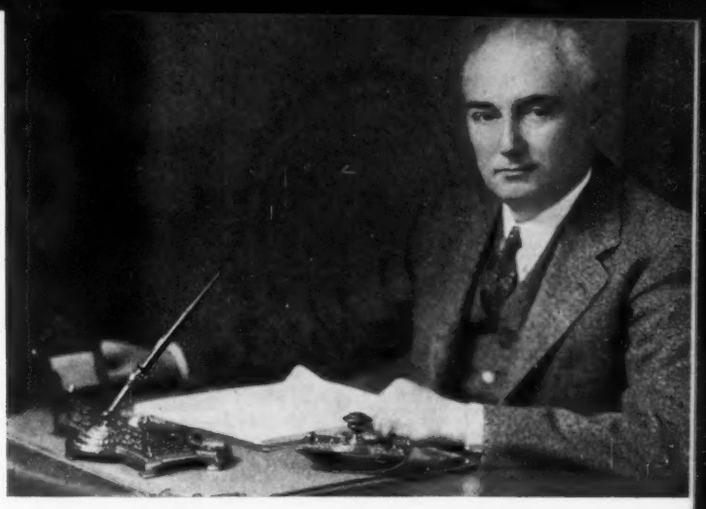
Machine Tool Current Drafts Creep Higher

STARTING CURRENT limitations have been fairly well liberalized by the utilities in their service-practice books, but a new trend in the machine tool field is sure sooner or later to bring up new questions. In the effort to make machine economies truly attractive, all possible intervening handling, especially of heavier parts, is being eliminated from the operations. This is all tending toward such combinations, for example, as superposing a shaper for keyway cutting on a turret lathe. Along with the concentration of more



—By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

Moreover, it is pointed out that the area in the Tennessee River valley which will be *permanently* flooded by the dams is greater than the area which has suffered from that river in any previous flood!

WHAT ABOUT irrigation? This is not involved in the Tennessee Valley project, but is in many others. One is permitted to wonder why the same government should pay farmers not to grow crops, because overproduction had reduced prices, and at the same time seek to bring into production more land for the same crops.

Which brings us down to the sole remaining reason for these dam projects—the production of cheap electricity.

Wendell L. Willkie, president of the Commonwealth & Southern Corporation, several of the subsidiaries of which are facing T.V.A. competition, discussed this at length in a recent article printed in the New York *News* in answer to a series of glowing articles by a *News* staff man about the T.V.A. project.

He makes the flat statement that if his companies could enjoy the T.V.A.'s government subsidies, both direct and in absence of taxation, they could supply current in T.V.A. territory at prices *25 per cent lower.*

Though usually very quick on the trigger, the T.V.A. press agents had not answered this claim when this article was written.

If we assume it is correct, then the users of T.V.A. electricity are *wasting* one-fourth of the work they do to earn the money which pays their electric bills. Not very much money to any one of them, of course, but why should it be *wasted?* If they could save it, they could buy something else with it. That additional purchase would aid some other industry, thus not only providing greater employment in that industry, and all which it patronized, but contributing to the federal treasury the additional taxes those various industries would pay.

This illustration of course is a flyspeck on the big picture. Every dollar the government takes in taxes for unnecessary projects, and for *waste* in necessary projects, is a dollar which otherwise would be spent or invested. If spent it would provide immediate employment by private business. If invested the same would be true. Added together, the sum total of these trickles and torrents of government waste of taxpayers' money would aggregate a total of private spending which would solve the relief problem almost overnight!

Which is the answer to the trite question: "Would you let them starve?"

* * *

Many times has the electric industry been attacked for being "in politics," its critics alleging that it was trying to run the government. Today probably the most ardent wish of the industry is that it could escape from politics. But to the disinterested observer there is a little humor in the situation.

Take the two great states of New York and Illinois and what has happened. It would seem to a visiting foreigner that a politician belaboring the electric industry would have as his chief object lower rates for current to consumers. President Roosevelt was Governor of New York for the four years from 1929 to 1933, and his close political follower Governor Lehman has been Governor ever since.

Yet electric rates in New York City and surrounding territory are much higher than in many other communities. Notably in comparison with Washington, D. C., where there has, curiously enough, probably been less politics in the regulation of the utilities than almost anywhere in the country. And which, incidentally, uses steam-produced current instead of the water-produced power so dear to Mr. Roosevelt's heart.

Gov. Henry A. Horner of Illinois has likewise been in power for four years. Yet there has been no reduction in electric rates in Chicago, or anywhere in the northern part of the state, during that period. The customers pay just as much, though it is true that the electric companies retain less, as they have been absorbing Governor Horner's 3 per cent sales tax.

And it just so happens also that electric rates in Chicago for householders are considerably higher than in many other communities, and way above the Washington non-political scale.

NOW COMES Governor Horner, on the eve of an election in which, as a candidate, he hopes to win another term, and *hints* at forcing a rate reduction in Chicago! *Hints*, mind you, not promises.

There is no purpose here to go into the technical reasons why rates in one locality might be cheaper than in another, nor whether the rates charged in New York City and Westchester, or in Chicago and northern Illinois, are higher than in Washington, D. C. The point is that there has existed for years the machinery for obtaining proper rates for the consumers of electricity in both communities. And that many experts, whose calculations the writer is not competent to criticise, are of the opinion that the rates in the country's two largest cities are too high.

And yet the men so enthusiastic about setting the government up in competition with private industry, who seem to seek to destroy it, have not helped their own constituents to obtain lower rates.

News OF THE WEEK

Third World Power Conference Hears Power Issue Debated

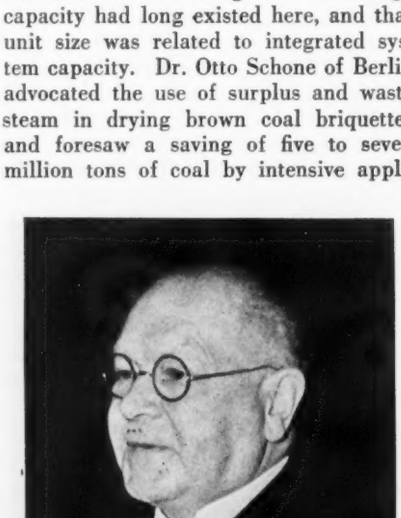
Visitors stress value of private enterprise — Conservation of natural resources discussed — British grid a topic of interest — Exhibits and social features add to success of convention

Seven hundred foreign delegates and a thousand American delegates met in Washington this week at the initial meetings of the Third World Power Conference. This conference was opened formally in Constitution Hall with four addresses of welcome, four replies and a feature address by Secretary Hull, who pleaded for the application of engineering talent toward constructive peace rather than the destructive conflict of today. A large share of scientific and engineering talent, he said, is being devoted to the creation and organization of forces of destruction. Dr. W. F. Durand, chairman of the American committee, called power engineers guardians of a trust which was reflected in the conference. It was their duty to conserve and to utilize power and natural resources in the public interest; these resources hold the key to the future progress of civilization.

Representatives from Canada, Argentina and Mexico joined in welcoming foreign visitors and replies were had from representatives of Belgium, Denmark, Lithuania and Italy. Most of Monday was spent in registration and in receiving exhibits that showed progress in American power and industry. This opening session Monday night prepared the way for the series of meetings to follow.

Abstracts on natural resources

On Tuesday the general topic of the morning session was the conservation and intelligent use of natural resources. Gano Dunn presided. Papers were presented in abstract only, giving, largely, statistics for the several countries. Some elements of the World War were reflected: Ludwig Kallir of Austria showed that the peace treaty took away her coal fields, and that Hungary, too, lost much of her hydro and fuel resources. Viscount Falmouth queried the use of large units in power generation, since Great Britain finds 30,000 kw. the economic size for the British grid. Walter S. Finlay, however, pointed out that interconnections of large area and large capacity had long existed here, and that unit size was related to integrated system capacity. Dr. Otto Schone of Berlin advocated the use of surplus and waste steam in drying brown coal briquettes and foresaw a saving of five to seven million tons of coal by intensive application of the process. J. M. Kennedy, president of the British I.E.E., saw little possibility in the economic use of tidal power and emphasized the reliance upon coal as the major source of power. When the British grid was started, excess plant capacity was 83 per cent. This has been reduced to 50 per cent, and in five more years would be down to 20 per cent. H. F. Quigley said that the integration and control of the grid involved finance and capital more than it did technical operations. The British are following T.V.A. with interest and anxiety. It looks to them as though this experiment is headed somewhere, but they are not quite sure where.



Wide World

Dr. Julius Dorpmueller of Germany, president of the Third World Power Conference, shown as he opened the conference in Constitution Hall, Washington, D. C., on September 7

Following this meeting the audience viewed the Abbot solar engine, which gives ½ hp. from 36 sq.ft. of sun ray collectors. British comment was that they were more in need of a fog motor. Unfortunately, however, the motor had burned out the day before.

Grid father speaks out

Dr. Charles Merz, who is known as the father of the British grid, sprang a testimonial that cleared up fake notions and false parallels. He said this grid was not imposed upon the industry by the government, but, on the contrary, the whole scheme was developed by the industry voluntarily as a feasible solution to its difficulties. Conditions in the United States, he said, do not call for the imposition of a grid by federal edict. Here, interconnected systems already exist, and the marvelous program of accomplishment would best be improved by reliance upon the exercise of the initiative and decision of the present leaders of the industry.

M. Deutsch of Belgium said all the world admired and applauded the United States for its accomplishments in electrification under private initiative. He does not believe that holding company financial abuses, when they occurred, had any effect on rates or electrical progress. He said there was a definite limit to consolidation and integration so far as economies are con-

cerned, and that the United States is too large and too well developed electrically to permit integration into a single electrical system.

Eduardo Salazar of Ecuador said it was best to let private capital develop electrical supply. There is too much of a risk element and too rapid a technological development to warrant the use of public funds. He inferred that Ecuador would give full encouragement to private capital if it would develop its power supply.

G. F. Lemaitre of Switzerland said 98 per cent of energy supply came from private enterprise and that this had made possible the astounding record of Swiss electrification. There is no endeavor nor even sentiment in Switzerland to have the government enter into the electrical business.

In Italy, too, there is no direct intervention by the state in electrical enterprises. Eighty-five per cent of the power supply in Italy, said Guiseppe Cenzato of Italy, comes from nine companies which act as holding companies for the local distributors.

E. F. Scattergood said that the economies of power supply were changing because of the development of less expensive and more efficient small thermal stations. He pointed out the advantages of decentralized branch manufacturing as an aid to integrated power, saying that municipal enterprises acted to spur rivalry in accomplishments. Mr. Horner of Belgium, however, said the holding company was a necessary as well as a convenient form of organization to build an integrated power supply.

Because of the death of Secretary Dern the White House reception was canceled. A ball held on Tuesday evening was the first social event of the conference.

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Consolidated Edison Combines Offices

A new business office of the Consolidated Edison Company of New York, at 32 West 125th Street, combining gas and electric activities was opened recently by Borough President Levy. Col. Leopold Phillip, president of the Uptown Chamber of Commerce, headed a delegation which attended the opening ceremonies, at which Frank W. Smith, president of Consolidated Edison, spoke.

The new office takes the place of two, a gas office and an electric office, quartered in different buildings. Additional consolidations are planned. Mr. Smith spoke of the improvement in the company's business practice to be gained by combining offices and the added convenience afforded customers. He pledged the company to constant improvement in service.

Utility Companies Carry Fight on T.V.A. to U. S. Supreme Court

Alabama and Texas utilities appeal in move to block P.W.A. power loans — Nineteen other utilities abandon Birmingham case — To press similar one in Knoxville

Litigation directed at the federal government's power activities have developed on two fronts as, in Washington, the Texas Utilities Company and the Alabama Power Company moved to appeal their case against P.W.A. power allotments to eight municipalities directly to the U. S. Supreme Court and, in the Tennessee Valley, the nineteen utilities contesting the validity of the Tennessee Valley Authority withdrew one of two duplicate suits in order to concentrate their efforts upon the other.

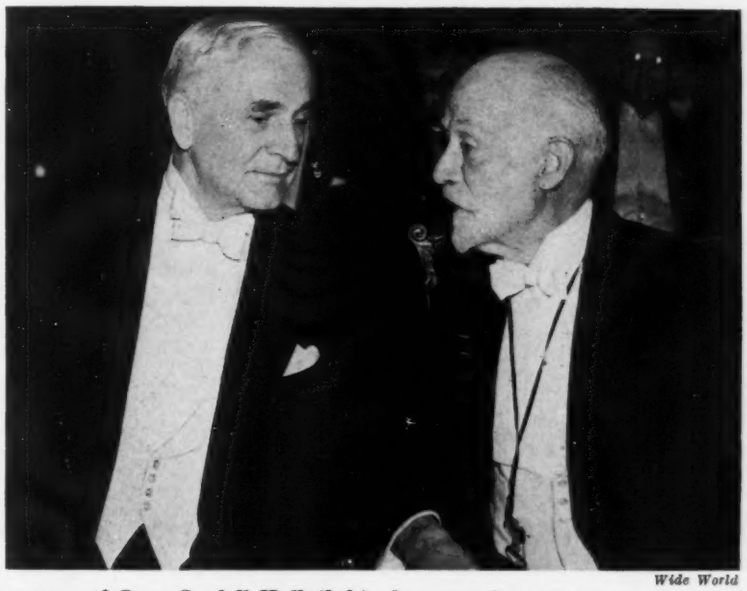
The Washington action was a request for the highest court to issue a writ of certiorari calling up for review a group of suits against P.W.A., allotments to Plainview, Tex., and Florence, Sheffield, Tuscumbia, Decatur, Hartselle, Guntersville and Russellville in Alabama. Injunctions against these loans and grants were denied by the District of Columbia Supreme Court. The issues raised are similar to those involved in the Duke Power Company suit against P.W.A. and Greenwood County, South Carolina, already on the court docket, and question the legality of federal grants for municipal power plant construction.

In the South the nineteen utility companies which last May entered duplicate suits challenging the constitutionality of the entire T.V.A. set-up petitioned the federal District Court at Birmingham, Ala., to dismiss the one in that jurisdiction. The government had already asked its dismissal on the ground that no new question was raised not settled by last spring's T.V.A. decision by the U. S. Supreme Court. The Birmingham court dismissed the suit.

The second case, brought in the Tennessee State Chancery Court at Knoxville, was transferred in July to the federal District Court in that city. T.V.A. attorneys have asked its dismissal on the ground that the authority can only be sued in northern Alabama, but no ruling has yet been made on this contention.

Court asked to appraise lines

In the first step to obtain T.V.A. power the city of West Memphis, Ark., has renewed efforts to buy the electric distribution system of the West Memphis Power & Light Company. The fight to carry T.V.A. power across the Mississippi River was intensified last week after the filing of a bill in Chancery Court in Marion, Ark., asking the court to fix the value of the utility's lines. The bill, filed by City Attorney Doyne Dodd, seeks to enforce an option in the 30-year franchise granted the utility in 1930. The option reserved



Wide World

Secretary of State Cordell Hull (left) shown at the opening session of the World Power Conference in Constitution Hall, where he delivered a speech which was the official welcome of the American Government to the conference delegates. On the right is Dr. W. F. Durand, president of the American National Committee of the conference

the right for the city to buy the transmission lines of the company and set up machinery to determine the value of the lines.

Under terms of the option, the city appointed an engineer to arbitrate and determine the value, but the utility failed to name an engineer who was to have sat with the city and another to be appointed by the two in working out the value. The bill would have the court fix the value of the distribution system or declare the franchise void because the company did not name an engineer.

T.V.A. failed to heed Judge Gore's order to file briefs and affidavits in reply to a motion of the nineteen power companies for a temporary injunction. September 5 was the deadline set by the judge for filing these documents (ELECTRICAL WORLD, August 29, page 107).

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T.V.A. Interferes in Electric Service

Breaking what is believed to be all T.V.A. speed records for power line construction, the authority has completed the building of a new 154,000-volt steel tower transmission line from Wheeler Dam, in Alabama, to Columbia, a distance of 65 miles, in approximately 70 working days.

The object of the line was to serve the large Monsanto Chemical Company, which, after originally negotiating with the Tennessee Electric Power Company, had signed up instead with T.V.A., explaining that the Chemical Company considered the power company situation "too precarious" on account of "the unfortunate competitive conditions" surrounding the power company.

This example of the T.V.A.'s alleged tactics in seizing the customers of private power companies is cited in an injunction which the Tennessee Electric Power Company and eighteen other companies are now seeking in the United States District Court, at Knoxville, to halt all T.V.A. power activities. The court is soon to hear arguments over the injunction.

T.V.A. construction crews, in their haste to complete the new transmission line, crossed high-tension wires with those of the Tennessee Electric Power Company and interrupted electric service to a large part of Columbia.

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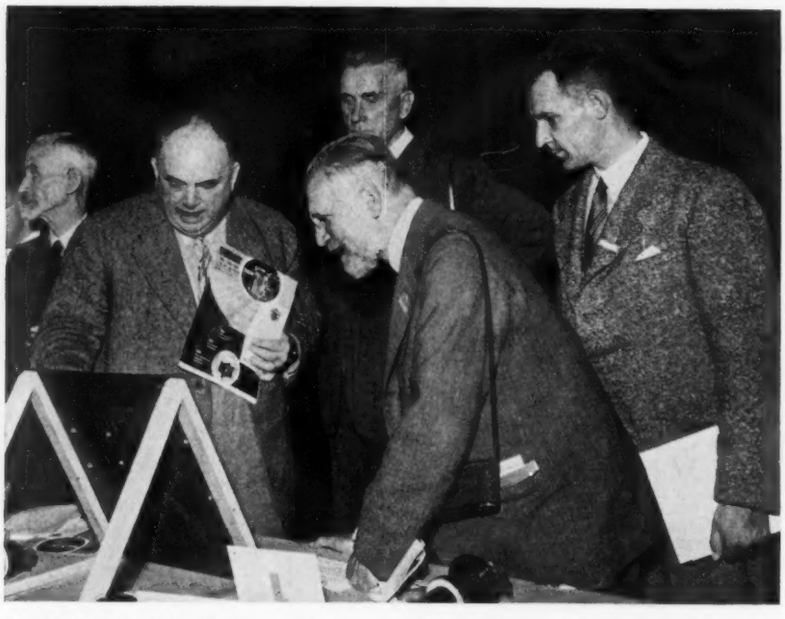
Gorgas No. 1 Plant Put in Operation

J. M. Barry, vice-president and general manager of Alabama Power Company, announced recently that the company was putting its Gorgas No. 1 steam plant into operation for an indefinite period, because of continued dry weather. "The initial load to be carried by the No. 1 plant will be 50,000 kw.," said Mr. Barry. He estimated that some 2,000 tons of coal would be required daily for the operation of the two Gorgas plants, plant No. 2 having been in operation since June 8.

DELEGATES INSPECT WESTINGHOUSE EXHIBITS



At the left is John Roberts, Electricity Supply Commission, Durban, South Africa, and examining exhibits (left to right) are Doktor August Menge, president Elektro-Werke, A. G., Berlin; Doktor Ludwig Kallir, Dipl. Ing. Hermann Bussman, Dr. Ing. Erich Rolf of Siemens-Schuckert-Werke, A. G., Berlin-Siemenstadt

Foreign Delegates Visit Power Units

Forty-three delegates to the Third World Power Conference who visited the important public utility systems of the East in connection with the pre-conference tours were entertained at Niagara Falls and Buffalo by a committee of engineers headed by Dr. N. R. Gibson, vice-president of Buffalo, Niagara & Eastern Power Corporation. Opportunity was given the guests to visit local points of engineering interest. The Welland Canal of the Canadian government, Queenstown-Chippewa hydro plant of the Ontario Hydro Commission and the Schoellkopf, Huntley and Harper stations of the Buffalo, Niagara & Eastern Power Corporation were also inspected.

Leaving Buffalo by boat, this group, which includes such men of international fame as Dr. A. Menge, president of Elecktro-Werke A. G., Berlin; Ludwig Kallir, director of A.E.G., Vienna; Dr. T. A. McLaughlin, member of Electricity Supply Board, Dublin, famous for his work in connection with the Shannon Valley Power Authority, and others, arrived in Cleveland August 31. Here they were greeted by Dr. W. E. Wickenden, president Case School of Applied Science, and divided into groups according to interests. Trips to Avon station, Cleveland Electric Illuminating Company, and the power plant of Firestone Tire & Rubber Company were arranged for those interested in steam power plants. The management group were given the opportunity to interview President E. G. Crawford of Cleveland Electric Illuminating Company, while the research group visited Case School of Applied Science. Dinner was served for the guests at Nela Park, where the whole group was personally conducted through the Nela Park Lighting Institute by the president, Dr. Kewley.

At Detroit tours of unusual interest had been arranged by the local committee, headed by Dr. C. F. Hirshfeld. Tours in the morning permitted the group to visit Connors Creek power plant, the electrical system of Detroit Edison, main offices of Detroit Edison or the General Motors Laboratories as desired. Lunch at the Dearborn Inn gave delegates a chance to rest before inspecting the Ford plant in the afternoon.

The Chicago program was arranged by L. W. Wallace, Association of American Railroads, and H. B. Gear, vice-president of Commonwealth Edison Company. Trips to Crawford and State Line stations were arranged for steam men, as were visits to Washington Park, Brookdale, Kenwood and Dearborn substations for those interested in electrical equipment.

At Pittsburgh, which the tour visited

Thursday, September 3, and Friday, September 4, trips through the East Pittsburgh plants of the Westinghouse Electric & Manufacturing Company and the Aluminum Co. of America were arranged. Here round-table discussions of the high points of the trip were held. Papers by D. M. Simmons, General Cable; Philip Sporn, American Gas & Electric Company; J. T. Lusignan, Ohio Brass Company, and others were read.

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Rural Co-operatives Hit Snags in Plans

Appeal to R.E.A. and state commissions against utility activities — Wholesale rates fought in Virginia — Calvert County also scene of hostility

Two of the local co-operative power projects under the sponsorship of the Rural Electrification Administration are having "spite line" trouble—one in Virginia's Shenandoah Valley, the other on Maryland's Eastern Shore. And both are uttering loud protests to R.E.A., to the state public utility commissions and to anyone else who will listen.

The Shenandoah Valley Electric Co-operative has been granted an R.E.A. loan of $125,000 with which to build 125 miles of line serving 543 consumers and has on file an application for $353,000 more to cover a much greater territory. It had planned to purchase wholesale power from the Virginia Public Service Company, which quotes a rate of 2½ cents. This the co-operative considers twice as high as is reasonable. The co-op's president has asked the State Corporation Commission to force the company to offer a more reasonable rate.

In Maryland the case is somewhat different. The Consumers Co-operative Company was organized to serve 492 customers in Calvert County by means of 68 miles of line. For this purpose it obtained an R.E.A. loan of $90,000, only to find that while this was being negotiated the local utility had obtained permission from the state public service commission to build new lines taking away 150 of its best customers, thus threatening the economic stability of the entire project. An appeal by the co-operative for recision of the franchise was refused.

To balance these set-backs, R.E.A. points with pride to the low bid for the construction of 254 miles of line for the Farmers Rural Utilities, Inc., of Bowling Green, Va., of $190,667.13, an average of very close to $750 per mile, not including meters. This covers the second unit of the Farmers Utilities' 406-mile project, and the low bidder was the firm which built the first 64-mile unit, now in service.

S.E.C. Issues Uniform System for Holding Company Accounting

The Securities and Exchange Commission announced this week the publication of its "Uniform System of Accounts for Public Utility Holding Companies" under the Public Utility Holding Company Act of 1935. The system becomes effective January 1, 1937.

The general instructions for the system state the new standards apply to those registered holding companies "deriving practically all their income from dividends and interest on investments in other companies. It does not meet the requirements of holding companies which also directly own and operate public utility or other property."

Representing the first comprehensive official standard for accounting practices in the holding company field, the system includes provisions designed to eliminate the practice of writing up the value of investments in balance sheets. This step is in accordance with the principles and provisions of the act. Other features of the system are requirements for the segregation of surplus to show what represents capital surplus and what is earned surplus, and a provision that stock dividends from subsidiaries may not be taken into income or surplus at amounts greater than those charged by the paying companies to their income and/or earned surplus accounts, and then only to the extent that such dividend is declared from earnings subsequent to acquisition by the company of the stock in respect of which the dividend is paid. The general instructions state:

"Investments acquired subsequent to the effective date of this system of accounts shall be entered in investment accounts at cost to the company . . . and retained therein at cost until sold or otherwise disposed of, or written down or written off in accordance with provisions of accounts herein prescribed."

Certain special provisions are made for the recording of investments acquired in reorganizations, bankruptcies, etc. In such cases, the accounting company, where there is no satisfactory valuation, is required to estimate the value of the investments, and to set up a reserve to take care of errors in such estimates.

"It is the intention," the instructions state, "that the reserve, so far as it is adequate, shall be used to adjust all differences between the amount originally set up on the books with respect to the items to which the reserve relates and values as finally determined; and that earned surplus shall be affected only by losses or gains clearly attributable to operations or events originating subsequent to date of acquisition and not inherent in the investments at date of acquisition."

With reference to the segregation of surpluses, the instructions prescribe that if, prior to the effective date, a separation between capital surplus and earned surplus has not been maintained, the surplus shall be segregated at that time or as soon thereafter as practicable, unless includible in its entirety in capital surplus or earned surplus.

On the matter of undistributed earnings, the accounting company "shall not take up on its books in income or other accounts the undistributed earnings of other companies regardless of the extent of its ownership in, or degree of control exercised over, such companies, except such undistributed earnings as may be includible in 'Dividends Receivable.'"

"CSP" PERFORMS FOR DELEGATES

World Power Conference delegates on pre-convention Tour III watch a CSP transformer go through its paces at the Westinghouse plant

Public Relations Stressed in Bedford

At meeting of Pennsylvania Electric Association Althouse gives five-point plan for establishing better understanding — I. L. Craig new president

With an attendance so large that it taxed the capacity of every hotel in Bedford, the Pennsylvania Electric Association closed its 29th annual convention at Bedford Springs Hotel yesterday after a three-day program devoted not only to internal utility problems but also to outside hazards. Philadelphia Electric Company's I. L. Craig was elected president.

In presenting a review of the year's activities, Mr. Althouse stressed an increase of $8,000,000 in the tax burden of the Pennsylvania companies during the past year, rate reductions of more than $9,000,000 and $7,000,000 of flood damages sustained by the Pennsylvania companies all of which Mr. Althouse said pose the problem of greater economies in operation to meet an increased burden equivalent to approximately 14 per cent of gross revenue, only a part of which will probably be regained from increased consumption.

"Understanding" was the subject of Mr. Althouse's address to the convention Wednesday evening, "Understanding—with the hope that we may establish a better understanding of our business by the customers we serve. The misinformation and lack of understanding among all classes of people of the problems of utility service is astounding."

Five major steps to be taken to correct current misunderstanding of the industry and its problems, Mr. Althouse said, are: (1) A cross-section analysis of the attitude of our employees as reflected by their contacts with our customers; (2) Instruction and training of our employees to meet our customers on a human basis; (3) a determination of the remedies necessary to correct wrong company practices and policies; (4) intelligent and understanding supervision over operations and employees actions, and (5) an aggressive plan for giving our customers understandable information about the business of rendering electric service, so that they may know the truth.

Congressman Charles A. Halleck (Indiana) pointed out that the nation as a whole suffers when zealous partisans take advantage of periods of economic stress to inject their pet theories of social reform. "It is absolutely silly," he said, "to demand of the managers of private business that they put men back to work and then hit them in the head with a governmental club every time they try to do anything."

"The National Safety Council states that 5 per cent of the industrial accidents were due directly to faulty illumination," said J. Russell Craig in his paper "Light Up for Safety." "If this 5 per cent were removed by proper lighting the cold cash saving to industry would be nearly $78,000,000 annually," he said.

G. W. Allison of Edison Electric Institute discussed the institute's national sales activities. In connection with rural sales, Mr. Althouse pointed to the nine-year-old Pennsylvania plan of rural electrification which has connected 188,000 rural homes and farms to 10,000 miles of rural lines. In 1936, Mr. Althouse predicted, 2,000 additional miles of rural line would be constructed.

Meetings

International Association of Electrical Inspectors — Northwestern section, Olympian Hotel, Olympia, Wash., September 14-16; Southwestern section, Hotel Fresno, Fresno, Calif., September 21-24; Southern Section, Hotel Adolphus, Dallas, Tex., September 28-October 1.

National Electrical and Radio Exposition — Grand Central Palace, New York, N. Y., September 9-19. Ralph Neumuller, secretary, 480 Lexington Avenue, New York, N. Y.

Maryland Utilities Association — Mid-year meeting, George Washington Hotel, Ocean City, Md., September 12. E. J. Hand, secretary, Clayton Building, Elkton, Md.

West Virginia Public Utilities Association —Annuel meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 18-19.

Rocky Mountain Electrical Association —Annual convention, Santa Fe, N. M., September 21-23. George E. Lewis, managing director, Gas and Electric Building, Denver, Colo.

Association of Iron and Steel Engineers —Annual convention, Detroit, Mich., September 22-25. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

National Electrical Wholesalers Association — Semi-annual convention, Hotel Statler, Buffalo, N. Y., September 28-30. E. Donald Tolles, managing director, 165 Broadway, N. Y.

Empire State Gas & Electric Association —Annual meeting, Saranac Inn, N. Y., October 1-2. C. H. B. Chapin, secretary, Grand Central Terminal, New York, N. Y.

Indiana Electric Association — Annual convention, French Lick, Ind., October 1-2. T. C. Polk, secretary-treasurer, 609 Traction Terminal Building, Indianapolis, Ind.

National Electrical Manufacturers Association—Netherland Plaza Hotel, Cincinnati, Ohio, October 4-10. W. J. Donald, managing director, 155 E. 44th Street, New York.

Electrochemical Society—Fall meeting, Niagara Falls, Ontario, October 7-10. Colin G. Fink, secretary, Columbia University, New York, N. Y.

National Electrical Contractors Association — Annual convention, Atlanta-Biltmore Hotel, Atlanta, Ga., October 12-14. L. W. Davis, secretary, 420 Lexington Ave., New York, N. Y.

Electrical Show Opens in New York

The 1936 National Electrical and Radio Exposition, described as the most comprehensive electrical and radio show yet held, opened on September 9, at the Grand Central Palace, New York.

A luncheon was given in the grand ballroom of the Hotel Commodore, at which the show was declared officially in progress. The speakers included Harry H. Barnes, vice-president of General Electric Company, and Ralph W. Wiley, president of the International Association of Electrical Inspectors.

The co-operation of the leaders in the national electrical equipment and radio fields assured the presentation of the most complete showing of equipment and facilities. Electrical refrigeration, heating, air conditioning, lighting, cooking, laundry equipment and a hundred and one accessories that are today considered to be necessities for the enjoyment of modern living are all represented in comprehensive exhibits, with practical demonstrations of use.

A striking exhibit shows reproductions of Menlo Park, where Edison invented the incandescent light, his first power station and replicas of the electric plants built by Edison, the beginning that made possible the great electric industry that has contributed billions to our national wealth.

Another feature of the show is the "Home of the Future," a one-room apartment that is a complete home in facilities and equipment.

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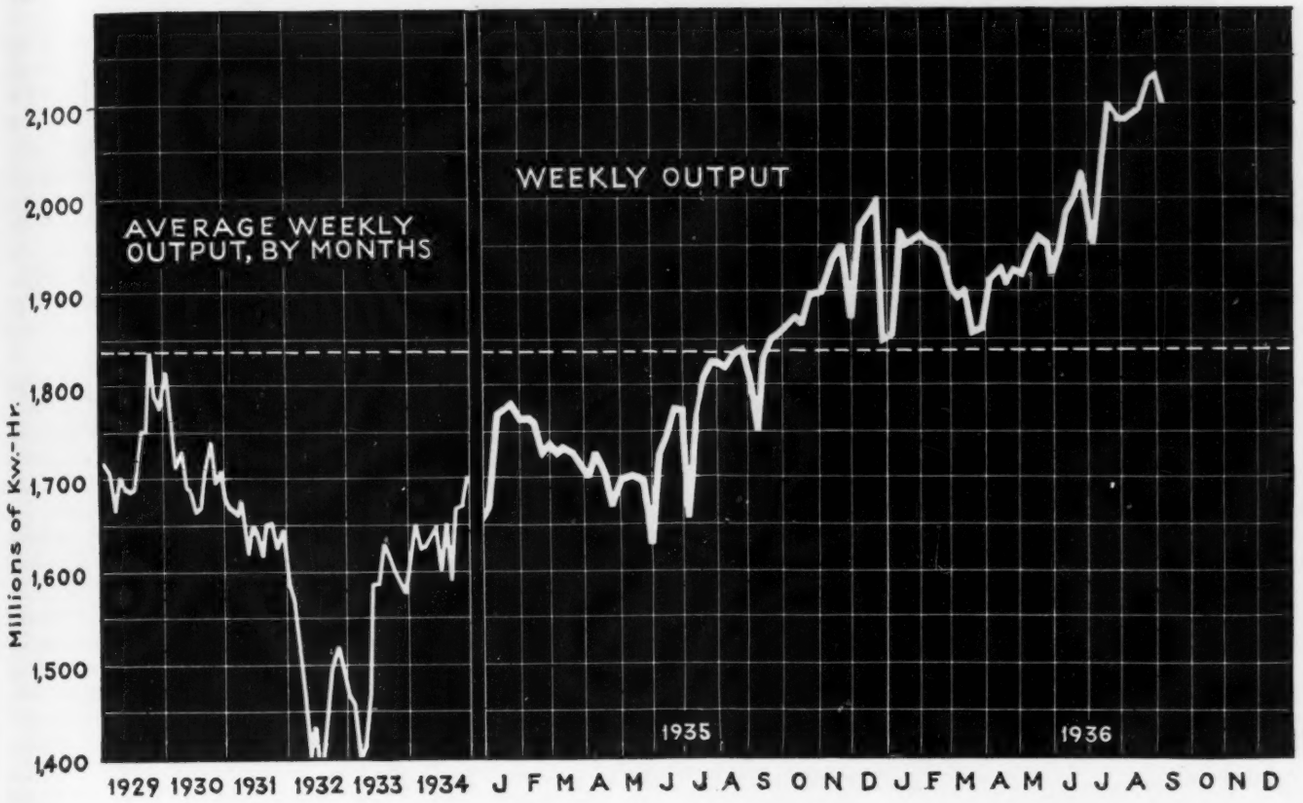
Power Crews Strike to Halt City Plant

In protest against a proposed municipal power plant, thirteen employees of the Missouri Public Service Company at Trenton, Mo., on September 4 went on strike and barricaded themselves in the company's plant, leaving the town without electrical service and facing a water shortage. The strike was short-lived, however, as officials of the utility company, the municipal government and the Rock Island Railroad pleaded successfully with the strikers to resume service pending negotiations over the difficulty.

The City Council precipitated the strike by voting on September 3 to award contracts for a municipal plant. At a conference attended by the strikers, company executives and city officials Fred Leucke of Warrensburg, Mo., president of Missouri Public Service, said: "I assume this strike is to show your loyalty to the company. However, it is up to the management, not the employees, to make any protest."

Output Pauses in Upward Sweep



Energy output by electric light and power companies in the week ended September 5 receded somewhat from the record-breaking peak of the latter part of August, while still matching the highest figures prior to that time. According to a tentative estimate announced by the Edison Electric Institute it amounted to 2,100,000,000 kw.-hr. This was 20 per cent more than in the corresponding period of 1935, but the comparison is of little significance since the week last year included Labor Day. For the same reason the Institute omitted the publication of the usual regional percentages.

Although the decline of 35,000,000 kw.-hr. may be indicative of a slight slackening in the demand for industrial power, a more probable explanation is that the holiday period was extended so as to embrace not only Labor Day itself but the preceding week-end.

Weekly Output, Millions of Kw.-Hr.

1936		1935		1934	
Sept. 5	2,100*	Sept. 7	1,752	Sept. 8	1,565
Aug. 29	2,135	Aug. 31	1,810	Sept. 1	1,627
Aug. 22	2,125	Aug. 24	1,839	Aug. 25	1,648
Aug. 15	2,094	Aug. 17	1,833	Aug. 18	1,674
Aug. 8	2,079	Aug. 10	1,819	Aug. 11	1,659
Aug. 1	2,079	Aug. 3	1,821	Aug. 4	1,658

*Tentative estimate.

Floating Substation to Supply Levee

A floating substation constructed on a river barge, bought by the Arkansas Power & Light Company at Memphis, Tenn., will supply the answer to the engineering enigma of how to supply electrical energy to a levee-building project launched recently on the gooseneck made by the Mississippi River at Greenville, Miss.

Sheer cliffs of some 30 feet flank the Mississippi side of Leland's Island just in front of Greenville, where levee construction will start. Unable to erect a substation on the island, due to the vertical walls and the varying levels of the river, which now is low, but which at times overflows the island, Arkansas Power & Light engineers secured a lease on a river boat and will establish their first floating substation. A 25-ton transformer will step down the voltage from the 110,000-volt lines in the section to proper strength for use in levee work.

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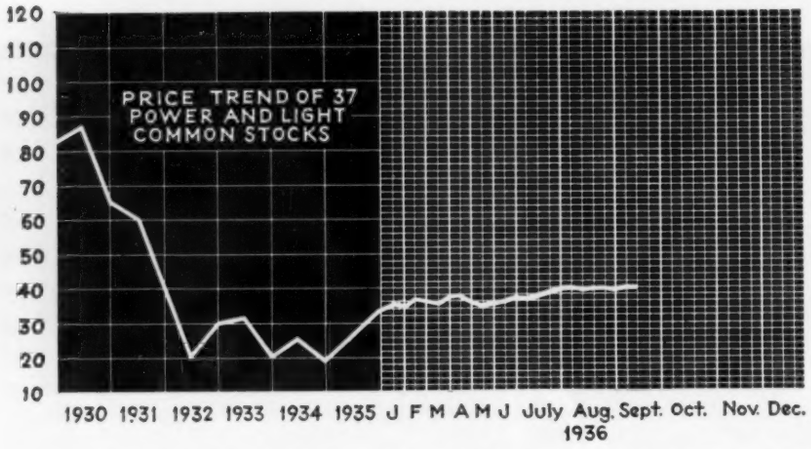
Training School to Open at Passamaquoddy Site

Housing facilities, shops and equipment at the unfinished Passamaquoddy tidal power project near Eastport, Maine, have been temporarily turned over to the National Youth Administration for use as a training school, according to a War Department announcement. Maintenance work at the project will still be a responsibility of the Army Engineers, but the school itself will be under N.Y.A. direction. Started with work-relief funds without the usual Congressional authorization, the Passamaquoddy project was suspended this summer shortly after Congress refused to vote funds to prosecute the work.

Plane Speeds Parts for Turbine Repair

Carrying two gears, a governor shaft and minor fittings belonging to a 160,000-kw. steam turbo-generator, engineers of the New York Consolidated Edison Company recently flew from the East Boston airport to New York to complete an emergency repair job in record time with the aid of the Lynn (Mass.) works of the General Electric Company. The order for the necessary parts was received at the River works late on a Friday night. Several departments were held open to forge blanks of special alloys, heat-treat and punch-press the material. The gears and other parts were machined and delivered to the customer's representatives by Saturday noon, and by 3 p.m. of that day installation began at the Edison station in New York.

Light and Power Stocks Gain



In a brisk trading market prices of electric light and power stocks advanced this week. "Electrical World" index, 39.2, the highest point since mid-August; last week, 38.9

Utilities Call Bonds for Payment

Two large utility issues of bonds were among those called last week for redemption before maturity. The following were included: All Cincinnati Gas & Electric Company first mortgage series A-4s, due in 1963, totaling $35.000.000. called at par for October 1; Southern Indiana Gas & Electric Company 5½s due in 1957, aggregating $5,500,000, at 105 for October 1.

The Gulf States Utilities Company has filed a registration statement with the S.E.C. covering $17,300,000 of first mortgage and refunding bonds, series C, 4 per cent, due October 1, 1966, and $4,000,000 of ten-year 4½ per cent debentures, due October 1, 1946, proceeds from which will be applied to refunding.

The commission has called a hearing for September 15 on the application by the Nevada-California Electric Corporation, a registered holding company, for issuance of a promissory note in place of an open book account amounting to $3,745,800, owed by the applicant to a subsidiary, the Nevada-California Power Company, which is to be merged with the applicant.

Application for exemptions from the requirements for filing declarations regarding two security proposals has been filed by the Cumberland County Power & Light Company of Portland, Me., with the S.E.C. One proposal is for $9,500,000 of first mortgage bonds due in 1966 and 10,000 shares of cumulative preferred capital stock, the proceeds of which are to be used to retire, on December 1, $10,418,000 of first mortgage gold bonds, 4½ per cent series, due in 1956. The other proposal is for $10,000,000 of notes to mature not later than December 31 next.

S.E.C. has approved application of Utilities Power & Light Operating Corporation for approval as a subsidiary service company.

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Michigan Utility Purchased

Consumers Power Company has purchased the Northern Power Company of Standish, Mich. The purchased company has approximately 2,500 customers. William M. Smith, chairman of the Michigan Public Utilities Commission, said that rates will be reduced to the same schedule in effect on other properties of Consumers Power Company.

Amended Plea Filed in $25,000,000 Deal

An amendment to the petition of four St. Louis stockholders for an injunction against the Utilities Power & Light Corporation asking for an injunction to halt a $20,000,000 to $25,000,000 sale of stock to a British utility concern has just been filed in the United States District Court in Richmond. This action followed a hearing on the petition in Norfolk, Va., last week at which petitioners seeking to restrain the Utilities Power & Light Corporation were informed by attorneys that $25,000,000 had already been received from the sale and that the money was on deposit in a bank in Montreal.

Judge Luther B. Way of Norfolk authorized the petitioners, four citizens of St. Louis, to file an amended bill asking that the case be returned to Judge Robert N. Pollard of Richmond, for whom Judge Way has been acting while the Richmond judge is on vacation.

The defendants were Utilities Power & Light Corporation, incorporated in Virginia but maintaining headquarters in Chicago; Utilities Power & Light, Ltd., of Canada, and ten acting directors of the American corporation (ELECTRICAL WORLD, September 5, page 16). The corporations attacked the jurisdiction of the court on the ground that it was a Canadian corporation, outside the jurisdiction of the court, which was disposing of the stock and that directors of the corporations, also named defendants in the action, are residents of other states and outside this court's jurisdiction.

Utility Earnings Reports

Company	Net Income 1936	Net Income 1935
Alabama Power		
Twelve months, July 31	$3,176,663	$2,972,690
American Power & Light		
July 31 quarter	2,045,657	1,206,364
Twelve months, July 31	9,599,192	6,233,835
Arkansas Power & Light		
Twelve months, July 31	958,665	897,717
Commonwealth Edison		
Seven months, July 31	6,161,457	5,985,516
Commonwealth & Southern		
Seven months, July 31	6,593,468	5,039,275
Twelve months, July 31	10,960,990	8,123,156
Community Power & Light		
(a) Twelve months, July 31	302,822	198,073
Connecticut Light & Power		
Twelve months, July 31	4,610,457	4,518,226
Consumers Power		
Seven months, July 31	4,879,221	4,582,944
Twelve months, July 31	8,289,686	7,453,448
Eastern Utilities Associates		
(a) Twelve months, July 31	1,887,935	1,737,681
Electric Power & Light		
July 31 quarter	1,346,760	(b)940,964
Twelve months, July 31	6,131,525	(b)200,294
Federal Light & Traction		
June 30 quarter	428,542	316,179
Twelve months, June 30	1,627,002	1,352,240
General Gas & Electric		
Twelve months, June 30	396,996	.....
Georgia Power		
Twelve months, July 31	4,763,471	4,270,922
Idaho Power		
Twelve months, July 31	1,182,728	950,583
Jersey Central Power & Light		
Twelve months, June 30	1,682,872	.....
Kansas City Power & Light		
Twelve months, July 31	3,883,223	3,391,903
Kansas Gas & Electric		
Twelve months, July 31	1,106,839	1,075,083
Louisiana Power & Light		
Twelve months, July 31	$1,169,080	$747,446
Louisville Gas & Electric		
Twelve months, July 31	1,664,252	1,362,020
Minnesota Power & Light		
Twelve months, July 31	1,300,114	783,487
National Power & Light		
July 31 quarter	1,312,530	1,046,918
Twelve months, July 31	6,631,405	6,082,089
Nebraska Power		
Twelve months, July 31	2,003,096	1,853,240
Nevada-California Electric		
Twelve months, July 31	1,077,404	.....
New Orleans Public Service		
Twelve months, July 31	366,055	360,038
North West Utilities		
June 30 quarter	48,683	(b)193,668
Six months, June 30	107,421	(b)300,064
Ohio Edison		
Seven months, July 31	2,218,563	1,908,804
Twelve months, July 31	3,761,811	3,291,158
Pacific Power & Light		
Twelve months, July 31	699,350	470,950
Public Service of No. Illinois		
(a) Twelve months, July 31	3,437,282	(c)
Sierra Pacific Electric		
(a) Twelve months, July 31	485,363	405,535
Southern Colorado Power		
Twelve months, July 31	170,064	170,072
Tampa Electric		
(a) Twelve months, July 31	1,343,922	1,289,429
Tennessee Electric Power		
Twelve months, July 31	2,160,367	1,913,771
Texas Power & Light		
Twelve months, July 31	2,134,069	1,665,667

(a) Report subject to audit and year-end adjustments. (b) Net loss. (c) Not available.

Manufacturing AND MARKETS

Steam Power at Conference Exhibit

"The boiler manufacturing industry has made every effort to show all types of equipment manufactured by the industry to its best advantage," said James D. Andrew, chairman A.B.M.A. exhibit committee, thanking the various manufacturers who co-operated in the preparation of exhibits for the Third World Power Conference.

"Since other exhibits so strongly stress the government's activity in the development of hydro-electric power," he continued, "it seemed of particular importance to attract attention to steam power plants as an economic source of power.

"With this in mind, the committee is exhibiting one of the largest and most efficient users of steam, and through the courtesy of the Franklin Institute in Philadelphia secured the loan of a very fine model of the 165,000-kw. turbo-generator recently installed in the Richmond station of Philadelphia Electric Company.

"It is interesting to note that this single unit has greater capacity than the entire Muscle Shoals hydro installation," Mr. Andrew declared.

Views of a part of the exhibit are shown in the accompanying picture and give some idea of the comprehensive display of steam-generating units, boilers, waterwheels, superheaters, air preheaters, economizers, stokers, pulverized fuel equipment and waste heat boiler installations.

In an important place at the exhibit is a chart taken from ELECTRICAL WORLD showing the steady improvement in the amount of coal used to generate a kilowatt-hour.

Conclusive evidence that the manufacturers of equipment for both generating and using steam in the production of electric energy have made remarkable contributions toward the conservation of fuel is the drop shown by the chart on the wall from 3 lb. of coal per kilowatt-hour to 1.47 lb. in 1935.

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Steam-Electric Locomotive for Union Pacific

A new steam-electric locomotive for the Union Pacific Railroad is to appear early next year on the Erie, Pa., test tracks of the General Electric Company. This passenger unit will carry a con-

STEAM POWER EXHIBIT AT WASHINGTON

The American Boiler Manufacturers Association and affiliated industries presented this exhibit at the new National Museum Building, Washington, D. C., in connection with the World Power Conference

densing steam turbine generating plant feeding electric power to traction motors and will be a double-cab locomotive, rated at 5,000 hp. It is to be streamlined, practically smokeless, and provided with equipment for air conditioning. According to the builders, it will develop speeds of 110 miles an hour on level tracks. It will haul 1,000-ton trains similar to the Union Pacific *Challenger* over the Los Angeles-Omaha route, say the reports.

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Toastmaster Sales Boom, Says Executive

Unit production up 155 per cent, sales 180 per cent over last year, and factory working night and day at top speed is the report of Kenneth G. Gifford, sales manager of the Toastmaster Products Division, McGraw Electric Company, Minneapolis, for the first month following formal announcement of the 1936-37 line to the trade. This boom has resulted in a 25 per cent increase in factory personnel, according to the report.

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General Electric Buys at Bridgeport

Charles E. Wilson, vice-president of General Electric Company, and C. K. Davis, president and general manager of Remington Arms Company, recently announced the transfer of some 324,000 sq.ft. of floor space and 14 acres of the Remington holdings at Bridgeport, Conn. The property is to be converted into headquarters for the General Electric Supply Corporation's sales and factory auditoriums, commercial display rooms and general purposes, it is reported.

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Allis-Chalmers Calls Bonds

Among several large issues of bonds called for payment last week in advance of maturity were $5,000,000 Allis-Chalmers Manufacturing Company convertible debenture 4s, due in 1945, called at 103 for October 5. It was also announced last week that directors had declared a dividend of 37½ cents a share on the common stock payable on September 30 to stock of record of September 14. On June 30 a dividend of 25 cents a share was paid.

New York Metal Prices

	Sept. 2, 1936 Cents per Pound	Sept. 9, 1936 Cents per Pound
Copper electrolytic	9.75*	9.75*
Lead, Am. S. & R. price	4.60	4.60
Antimony	11.75	11.625
Nickel ingot	35.00	35.00
Zinc spot	5.225	44.625
Tin Straits	43.125	5.225
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley

Field Reports on Business

Reports to ELECTRICAL WORLD *from the field indicate that business has resumed after Labor Day at the high rate characterizing recent weeks. Merchandising lines continue sharply higher than a year ago. Heavy industry, if it can be judged by steel production, is going at the best rate since 1930. Higher steel prices have been posted and copper threatens to go higher.*

NEW YORK

Those who make a business of interpreting business news are busy hunting for something that isn't favorable—things right now are looking too uniformly good to be true. Merchandisers are showing uniformly large gains over last year, although August didn't quite keep up July's bonus-fattened increases. Railroad carloadings are running at the highest level since the autumn of 1931. Motor car sales held up surprisingly in August and manufacturers are rushing to get into production on new lines.

Last month's steel ingot production (that was the month when the midsummer lull was supposed to set in) totaled 4,195,130 tons, against 3,922,731 in July. The August figure was the highest since March, 1930, and September, so far, is about equaling August operations.

There has been more evidence of the underlying firmness of the general price structure this week. Foreign copper prices topped the 9¾-cent domestic level and producers abroad (as was the case in this country a fortnight ago) fell back on increased production to prevent a further mark-up in quotations. Large producers here and abroad are attempting to prevent an advance which would encourage too swift a rise in output, although higher prices are expected by the end of the year.

NEW ENGLAND

Almost without exception, comments from representatives of prominent electrical manufacturing companies are that business is good; inquiries for price and delivery for widely diversified electrical supplies are being received in good volume and the prospects for continued buying appear now to be bright throughout this district.

Small motor sales lead by a wide margin the volume reported last year at this time. Machine manufacturers are prominent in buying; fractional-horsepower motor sales have begun to spurt due to rush demands from appliance and tool manufacturers in this district. Switch and control apparatus is moving well. Installations of special electrical equipment are reflecting orders of interest. The Boston Edison Company is planning to install phase-angle correcting equipment this fall to facilitate interconnected operation beween its generating plants and the New England Power Company system. Plans for a rural line extension to serve about 100 customers are being pushed for Charlton, Mass., by the New England Power Company. An additional $55,000 has been allotted by other interests for rural electrification in western Massachusetts.

Interest in electrical commercial cooking is quite active. A recently purchased electrical coffee-making installation was added to a well-known Worcester restaurant. Electric range sales in Worcester are brisk, and now about 1,000 such ranges are operated on the Worcester Electric Light system. New interior lighting is advancing; recently new lighting and air conditioning were installed in one of the Boston University buildings. Evidence so far received points to the greatest lamp year yet for the Hygrade-Sylvania Corporation factory at Salem, Mass. New construction is leading toward more sales of electrical supplies.

PACIFIC COAST

Every business factor except certain labor aspects is favorable for a year which may even top 1929, especially with gradual increase of industrial activity. August business rounded out a six months' period of steadily mounting supply sales with a very fair backlog for September. Power company revenues are mounting as indicated by Pacific Gas & Electric Company's recent all-time new high daily record and Puget Sound's doubling of net income for fiscal year ending July 31, over the previous twelve months.

San Francisco's Exposition construction to the value of $2,000,000 has been delayed by dredging of the island site, but army engineers are augmenting their equipment to 7 dredges with a 2½ million cubic yard monthly performance as goal. Much large government work will break during these two months, including a $6,000,000 postoffice for Los Angeles, a $650,000 structure for Spokane, and new postoffices, averaging $200,000 each, for Pasadena, Seattle, Hilo and Honolulu, with smaller structures for interior cities, such as Auburn and Downey.

But much apprehension is felt over the last quarter of the year, despite these factors, because, barring the chance of Federal mediation, Pacific Coast shipowners and associated marine unions appear headed for a bitter showdown on long-disputed issues, with its concomitant of a paralyzing wholesalers' warehouse strike.

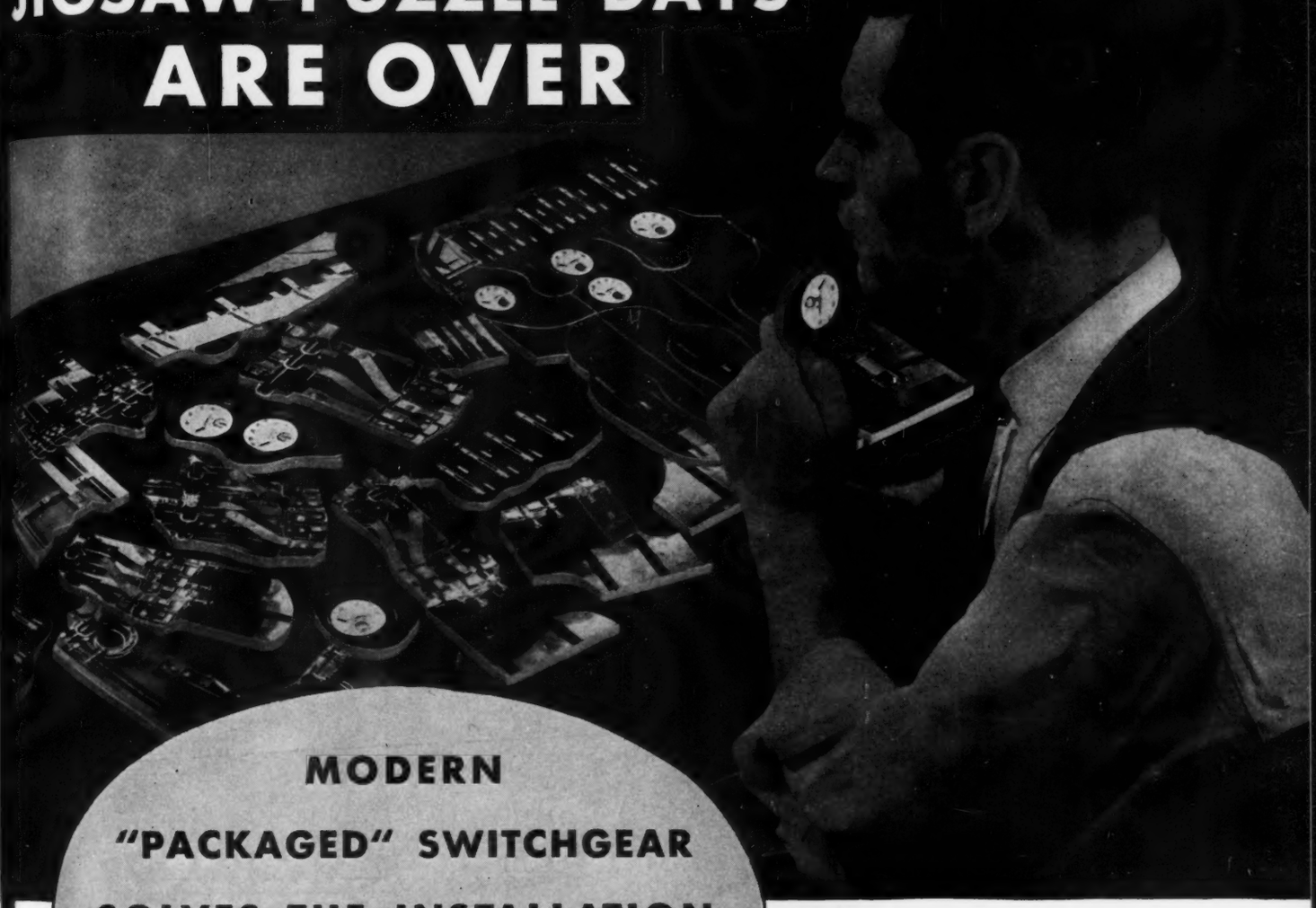
CHICAGO

Ending the summer at a brisk pace, fall trade prospects are exceedingly bright and an attitude of irrepressible optimism prevails in most quarters. Consumer demand continues unabated, retail and wholesale trade are running far above last year, summer industrial activity exceeded expectations in practically every field, factory employment and payrolls are up and general activity in consumption goods is having its effect on the heavy goods industries. Steel mills continue to operate at a high rate of capacity and electrical energy output again rose to an all-time peak.

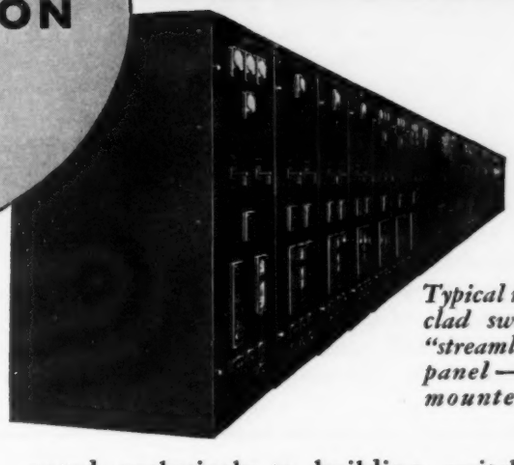
One large electrical manufacturer reports an increase in sales of 67 per cent to date, with unfilled orders amounting to $10,000,000. An appliance manufacturer reports sales more than double those of a year ago. Six 1,125-kw. pumps have been installed in a new pumping station. Sodium-vapor lamps are being installed on a mile of road to give Illinois its first illuminated highway.

Electrical wholesalers in this area report sales up 7 per cent over the previous month and an increase of 58 per cent over the same month last year. Collections show the same degree of improvement.

JIGSAW-PUZZLE DAYS ARE OVER



MODERN "PACKAGED" SWITCHGEAR SOLVES THE INSTALLATION PROBLEM—AND SAVES YOUR TIME



Typical modern metal-clad switchgear with "streamlined" control panel — all devices mounted semiflush

IT comes to you complete, all assembled, and ready to work. You simply bolt it down and connect the leads.

That's because the "packaging" idea has been applied to G-E switchboards. It's the modern way and has many advantages. Be sure that your next switchboard is a General Electric, and the benefits will be yours.

Besides a saving in installation time, think of the quality of workmanship — assured by the specialized engineering and factory facilities of our Philadelphia works — the largest plant devoted exclusively to building switching equipment.

You will also be assured of better appearance—because modern G-E boards are streamlined. All the devices are mounted semiflush—built-in, not hung on. No wonder that the practice of building one's own boards is outmoded.

Ask our nearest office to quote on your switching requirements. General Electric, Schenectady, N.Y.

860-17

GENERAL ELECTRIC

Field OPERATING PRACTICES

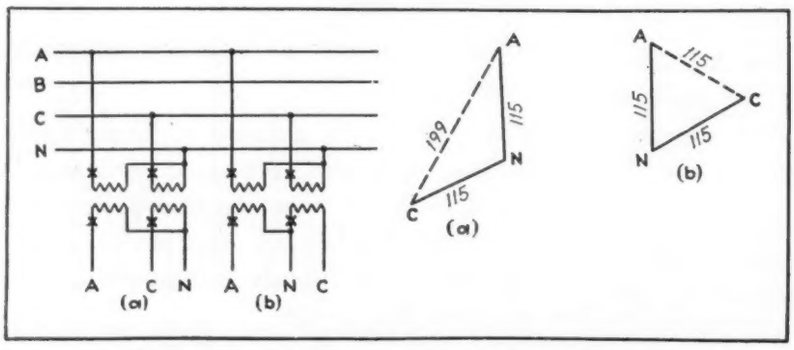
New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Modified Connections Simplify Test Set-up

By W. G. PARMENTER
Superintendent of Meters
Georgia Power & Light Company, Valdosta

One of the reliably accurate approximations to rigorous Blondel metering of three-phase, four-wire circuits is the Z-coil meter in which each of the two elements is a three-wire element. This meter leads to inaccuracy under unbalanced voltage conditions only when the vector sum of the voltages departs from zero. This is not likely to happen if the supply is derived from a delta-Y bank because of the proportionality of the Y voltages to those in the delta, which must add vectorially to zero.

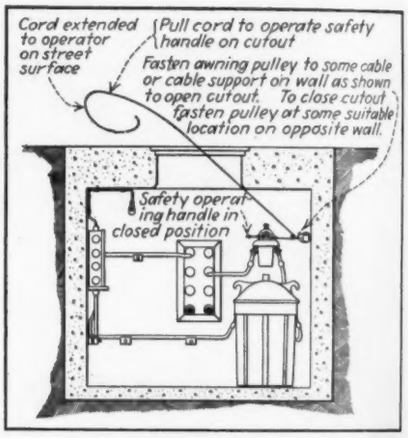
Of course, an ordinary two-element meter will suffice if current transformers are used, the Z circuit then being served by a third current transformer which supplies reversed current to the two current windings. A convenient practice in connection with such meters has been adopted wherever voltage transformers are also used. It involves reversing (as in (b)) the secondary of one of the voltage transformers and, to compensate, the current coil connections in the corresponding element. This gives balanced three-phase voltages at the test block so that all tests can be made exactly as on a three-phase, three-wire circuit.



Test block conditions same for 4-wire and 3-wire
By reversing as in (b) the standard connections as in (a) the three test-block voltages are rendered alike as indicated by the vector triangles.

Hazards Eliminated by Cutout Wrench

On systems having underground installations several years old the hazards of working in underground vaults are increased by the possibilities of an explosion of an oil-filled cutout. The internal condition of such apparatus cannot be determined from an external inspection and cutouts which have been in service a number of years may be low in oil or have other faults which endanger their interrupting capacity under load. On one large Western utility, a cutout explosion seriously injured an employee both from flying metal fragments and from flaming oil.


Cord extended to operator on street surface
Pull cord to operate safety handle on cutout
Fasten awning pulley to some cable or cable support on wall as shown to open cutout. To close cutout fasten pulley at some suitable location on opposite wall.
Safety operating handle in closed position
Wrench Detail
Rivet top and bottom pieces to main stem with 3-3/16" rivets
Rivet one piece of 1/8" steel plate to each side of handle with 2-3/16" rivets
Insert 2-1/16" washers to provide proper spacing and support for locking link

Method of operating underground cutout with safety wrench. Wrench detail shown above

To prevent reoccurrence of such an accident, a wrench was designed which permitted the operator to either close or open a cutout from above ground. Simple in construction, it consists of an offset head with a locking link. It is affixed to the movable element of the cutout and operated by means of a stout cord or chain which passes through a small awning pulley and then out through the manhole. Slight modifications of the wrench may be necessary for the various types of cutouts, but the principle can be adapted to practically every cutout used in ordinary service.

"...and here's the biggest little feature of them all... main contacts SOLID SILVER"

Better Protection -and Less Attention

SILVER contacts, welded to solid copper, give G-E air circuit breakers three operating advantages that users value:

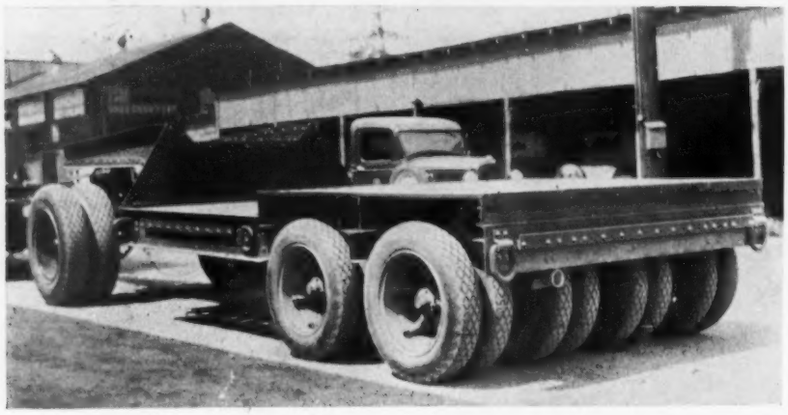
1. Superior performance—because silver eliminates troubles due to oxidation and consequent overheating.
2. Minimum attention—because solid, silver contacts require no cleaning to reduce temperature rise.
3. Longer life—because of the permanence of solid construction.

Why not obtain these advantages of solid, silver-to-silver contacts. Specify G-E breakers. General Electric, Schenectady, New York.

GENERAL ELECTRIC

860-8

Moves Substations With 30-Ton Trailer



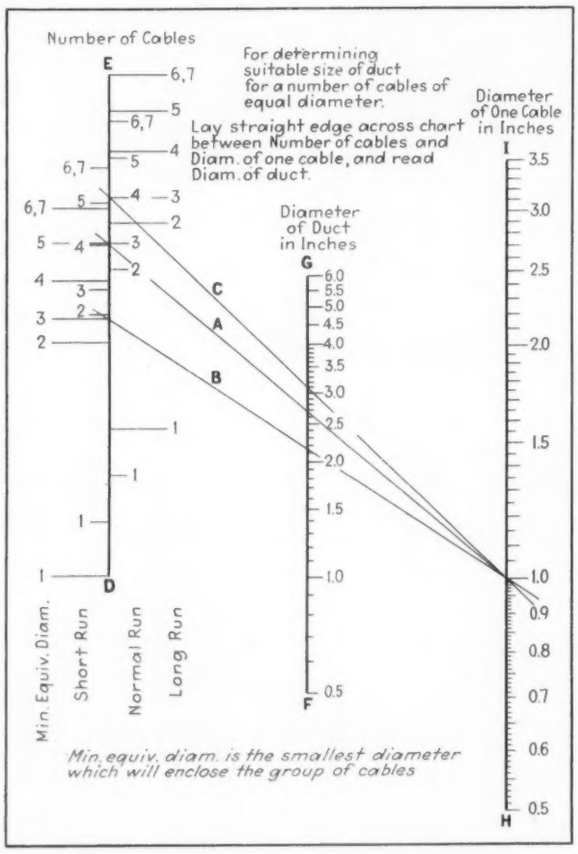
Alabama Power Company had the Fruehauf Trailer Company build this trailer. The cost was approximately $3,500. It is equipped with four 10½-in. tires on front and sixteen 32x6 tires on rear. Trunnion-type rear axle eliminates springs, but allows all wheels to maintain contact with road. Brakes are vacuum hydraulic and hand for emergency and standing

Duct Sizes Found by Quick Method

By FRANK F. TULLOCH
Assistant Division Head, Underground Division, Distribution Department, Boston Edison Company

To do away with lengthy computations of the sizes of ducts required to accommodate underground cable, the accompanying chart has been devised on a letter-sized sheet. Only a straight edge is required to utilize it. The runs embraced by the chart are classified as "Long," straight runs of from 400 to 700 ft., or runs with one quarter-bend 150 to 250 ft. in length; "Normal," straight runs 250 to 400 ft. long; runs with one quarter-bend up to 150 ft. long; or runs with three quarter-bends up to 50 ft. long, and "Short," straight runs up to 250 ft. long or runs with one quarter-bend up to 50 ft. long.

The chart is used as follows, taking a typical set of queries:


Number of Cables
For determining suitable size of duct for a number of cables of equal diameter.
Lay straight edge across chart between Number of cables and Diam. of one cable, and read Diam. of duct.
Diameter of One Cable in Inches
Diameter of Duct in Inches
Min. Equiv. Diam.
Short Run
Normal Run
Long Run
Min. equiv. diam. is the smallest diameter which will enclose the group of cables
A
B
C
D
E
F
G
H
I

(A) Given three 1-in. outside diameter cables and a normal run, what size duct is required?

Lay a straight-edge across the chart from point 1.0 (the cable diameter) on scale HI to point 3 on scale DE (number of cables) corresponding to the vertical row of figures above the "Normal run" abscissa. The position of the straight-edge is indicated by the diagonal line "A." Where this line "A" crosses the vertical scale FG (the duct diameter scale) it reads 2.7, which is the diameter of duct that will accommodate the three cables. The next duct size above this diameter is 3 in., and this is the required size for operating conditions.

(B) Given three 1-in. cables, what is the smallest duct which will inclose them mathematically? That is, what is the minimum equivalent diameter of duct to house them?

Lay a straight-edge from point 1.0 (the cable diameter) on scale HI across the chart to point 3 on DE (number of cables involved). Point 3 in this case is referred to the abscissa "minimum equivalent diameter." The diagonal line "B" representing the position of the straight-edge cuts across scale FG at 2.15. This is the minimum equivalent diameter required in answer to the query, and the difference between this point on FG and the 2.7 point reached in query A is 0.55 in., or the available clearance between the duct size required for a normal run and the minimum mathematical diameter required.

(C) Given three 1-in. cables and an assumed long run, what is the size of duct needed?

Lay a straight-edge upon point 1.0 scale HI as before and let it intersect the vertical scale DE at the point where the horizontal line from 3 (above the abscissa "Long run") intersects DE. Line "C" indicates the position of the straight-edge. The straight-edge crosses scale FG (the duct diameter scale) at 3.1, and this is the required diameter. The next size of cable available is 3.5 in. and this is the answer.

The procedure is similar for short runs of cables, and for other sizes and numbers of cables to be grouped in ducts.

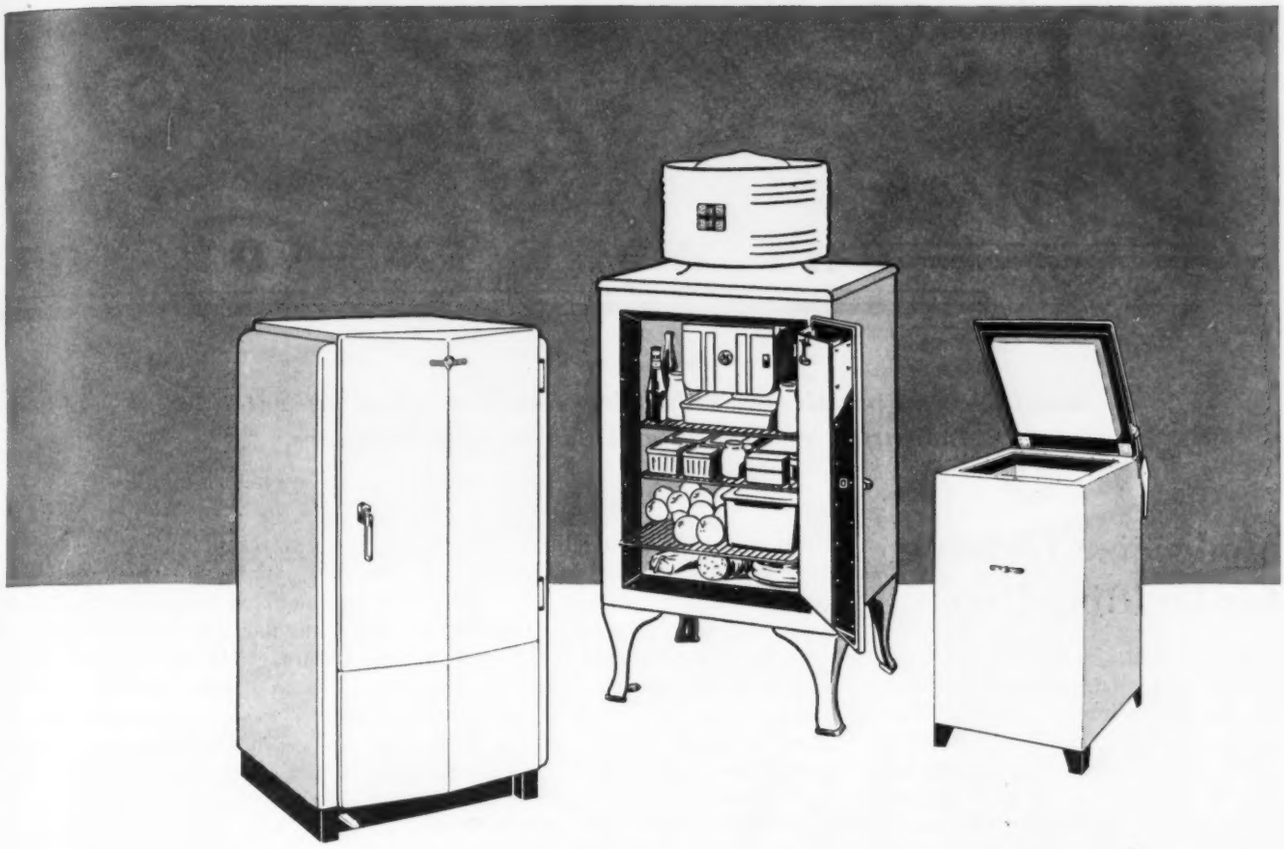
•

Sticking Contacts Easily Cured

Trouble is often experienced with the copper-to-copper and brass- or bronze-to-copper cutout and switch contacts sticking together after long periods in the closed position. This is due to formation of a thin film of oxide, making operation of the cutout or switch difficult.

A simple, effective and inexpensive cure for the trouble was recently reported in an issue of *Matthews Matter*. It consists in coating the male and female parts of the switch with a compound consisting of automobile water pump grease, finely ground pumice stone and finely ground crocus abrasive (obtainable at any plating supply house). To one pound of the grease, add 3 1/3 oz. of fine pumice and 3 1/3 oz. of finely ground crocus. Mix thoroughly and apply with a brush or putty knife.

A heat run test on identical samples showed a temperature rise above ambient of 23 deg. C. for the treated contacts, after constant temperature had been reached, as compared with a rise of 20 deg. C. above ambient with untreated contacts. Since a 30 deg. C. heat rise is permissible, the difference in either case is well within the limits allowed.



OVER A BILLION KWH'S HAVE BEEN ADDED TO SERVICE LINES WITHIN FIVE YEARS BY ONE G-E APPLIANCE ALONE!

● Every minute of every day somebody buys a **General Electric Refrigerator.** There are now nearly two million in use and the famous sealed-in-steel G-E Thrift Unit mechanism has a performance record unmatched by any other refrigerator in the world. In the past five years this one General Electric appliance **alone** has increased the use of KWH's by more than a billion. **But that's not all:**

General Electric Range sales have also been pyramiding year after year, with 1936 volume 'way ahead of last year.

And, **General Electric Dishwashers** are showing a sales increase this year 500% ahead of 1935. The G-E Dishwasher is destined to be one of the great load builders of tomorrow for it is encouraging the purchase of **General Electric Water Heaters** —an important factor in load building.

The **General Electric Disposall** is the newest G-E kitchen appliance. It disposes of food refuse right at the sink and flushes it out the drain like dishwater. It eliminates the garbage problem and has met with instant and nation-wide public approval.

G-E appliances have won unparalleled public preference through unparalleled performance—and General Electric offers the **only** complete line of electrical servants for the home. General Electric Company, Appliance and Merchandise Department, Section DJ-9, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC

Power AT WORK IN INDUSTRY

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Modernize Lighting for Drafting Room

A new drafting room building for the gas power engineering department of the International Harvester Company, Chicago, has been erected in which fundamental emphasis has been placed on the comfort and efficiency of working conditions. The central drafting room in this building is 145x 75 ft. in area and is fully air conditioned and lighted with modern equipment. More than 100 engineers, inspectors and draftsmen are located in this area. Walls of the building are windowless, daylight illumination is provided by skylights in the sawtooth roof.

Artificial lighting was chosen with particular emphasis placed on obtaining a glareless light which would blend well with the daylight on dark days and during other periods of reduced daylight.

Lighting units themselves combine a straight mercury-vapor tube and a number of incandescent lamps beneath a single reflector. With diffusion glass, mounted in an angular relation beneath the lamps, the intrinsic brightness is low enough to permit one to look directly at the light sources without a sense of discomfort. Eighty units of this type have been installed operating at 850 watts. Units are mounted 11 ft. directly over and parallel to the left-hand edges of each of the drafting tables. Spacing of the tables and cabinets has been correlated to the lighting layout to provide a uniform illumination of 20 ft.-candles.

Units of the type used in this installation are made by the General Electric Vapor Lamp Company. The incandescent component of the light is supplied by four 150-watt Mazda lamps mounted in a horizontal plane in an angular relation to the axis of the fixture. A 33-in. mercury vapor tube 1 in. in diameter is mounted below these sockets along the axis of the fixture. This tube and its operating auxiliary are of an improved type, supplying the same lumen output at 285 watts as was formerly supplied by 350-watt, mercury-vapor tubes. They are equipped with Alzac aluminum reflectors and diffusing panels designed to combine efficient light distribution with clean external appearance.

Combination mercury-vapor and incandescent lamp fixtures provide 20 ft.-candles of illumination for drafting work

•

Cable Lengths Great Help in Maintenance

By K. B. HUMPHREY
Sayreville, N. J.

The maintenance gang of one large company has among its equipment some items which it considers indispensable. Among them are two 300-ft. sections of four-wire flexible electric cable, which can be used singly or in series for supplying three-phase, 220-volt current with the fourth wire for ground. The cables can be used to hook up portable conveyors or electrically operated centrifugal pumps whenever it is necessary. The conveyors save time when loose material is to be handled or for general clean-up. The pumps are used for various purposes, such as pumping out excavations or for drying up some barges or pumping out underground flues or tunnels.

These cables have often been used for 110-volt circuits. For 220 volts a regular plug is used, but for 110 volts

PROTECTION
To the DUCK, water is not wet. His soft down and feathers keep him warm and dry. Thus, Nature equips him with good PROTECTION.

CHROMEL heating-element wire has its own Protection, too—against "burn-out". That is, in use it forms its own protective coating which the air can scarcely penetrate. Thus the oxygen is kept away and fine durability results. . . . Chromel was sufficiently good in 1906, when it was discovered, that it created the electric heating device industry. Today Chromel is better than ever before, and gives safe protection to your profitable heating load. Thus, you protect your own interests when you specify or recommend Chromel heating-element wire. Catalog-KW contains handy and easily used information. Send for it. . . .

HOSKINS MANUFACTURING COMPANY • DETROIT, MICHIGAN

HOSKINS

CHROMEL

THE *wire* THAT MADE ELECTRIC HEAT POSSIBLE

the cable is tapped near the plug and hooked in on a service switch wherever it is needed. By tapping in an ordinary weatherproof socket at the other end an electric drill can be used up to a considerable distance from the nearest current supply. With an extra cord attached to the drill it was possible to use it at a distance of 700 ft. from the supply. A railroad trestle had to be repaired out in the yard and the time saved in drilling the holes in the wooden stringers for this one job would go a long way in paying for the cost of the cables.

•

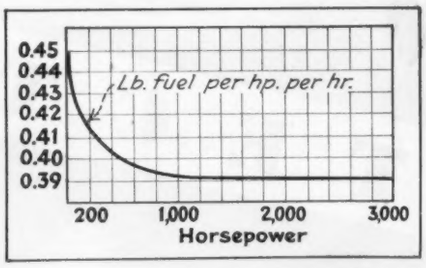
Fuel Consumption of Diesel Engines

By W. F. SCHAPHORST
Newark, N. J.

"If we should drive our generator with a Diesel engine how much fuel would it consume?" That question is often asked by officials who are considering the use of a Diesel for power purposes. Too often the question is sidestepped by salesmen who are afraid of committing themselves. They reply, "it all depends upon the size required," or words to that effect, and the prospective user is mystified by the intricateness of the situation.

In an effort to answer the above question definitely data have been gathered on fuel consumption by Diesels of numerous sizes and are developed on the accompanying curve. This curve tells at a glance what good Diesels are doing today, the horsepower varying from the smallest sizes up to and including 3,000 hp.

For instance, if your requirements are very small—50 hp. or even less—you can figure on a fuel consumption of 0.45 lb. per horsepower per hour with a modern engine. If you need a 100-hp. Diesel the consumption will be about 0.42 lb. per horsepower-hour. The curve shows that with increase in engine size the fuel consumption improves rapidly from the smallest sizes to 200 hp. From 200 to 1,000 hp. the improvement is less rapid. And from 1,000 to 3,000 hp. the improvement is very slight, being practically 0.39 lb.



Fuel consumption of typical Diesel engines

per horsepower per hour for all of the sizes in that range.

To determine the efficiency of any engine size, with any fuel, multiply the B.t.u. value of the fuel per pound by the number of pounds per horsepower per hour and divide the product into 2,546. For example, if the fuel contains 20,000 B.t.u. per pound and you will require a 500-hp. engine the chart shows that you must multiply 20,000 by 0.40, which gives 8,000 as the product. Now divide 2,546 by 8,000 and it will be found that the engine will have an efficiency of 31.8 per cent, which is a high efficiency as compared with most engines of other types. It means that 31.8 per cent of the heat contained in the fuel will be converted into work. Even at 0.45 lb. of fuel per horsepower per hour, other conditions being the same, the efficiency will be 28.3 per cent, which is a *high* efficiency.

•

Cost of Motorizing Farm Machinery

Electric motors offer the greatest possibilities for electrifying the farm. Any list of the uses of electricity on the farm will show that approximately two-thirds of all uses are dependent on the electric motor. When continual use or the application requires, the motor is usually made an integral part of the machine. Yet there are many pieces of equipment where it would be real economy to change to electric drive. Some of these are operated by hand, others by internal combustion engines. There are other machines whose intermittent or seasonal use does not justify the investment in a motor for one use alone. It is these machines which offer a tremendous possibility to save labor, time and money for the farmer and at the same time give desirable load to the power company.

The accompanying table gives the size motor required and the approximate kilowatt-hours to do various farm jobs and is suggested by B. P. Hess, rural electrification department of the Westinghouse Electric & Manufacturing Company. Operation cost is given in understandable farmer-known units and can be used by him to "sell himself."

Power Data for Motorized Farm Machinery

Farm Machines	Motor Horsepower Smallest	Motor Horsepower Largest	Motor Horsepower Size Most Used	Approximate Kw.-Hr. Consumption
Feed grinders	1	7½	5	0.2 to 2.0 per 100 lb.
Ensilage cutters	5	15	5	0.8 to 1.5 per ton
Corn shellers (single hole)	¼	1½	¼	1 per 300 lb. shelled
Fanning mills	¼	½	¼	1.5 per 100 bu.
Grain elevators	½	5	3 and 5	2 to 8 per 1,000 bu.
Concrete mixers	½	10	½ and 5	5 per cubic yard
Hay hoists	3	10	5	0.4 per ton hoisted
Root cutters	¼	5	1	0.2 per 100 lb. roots
Wood saws	3	10	5	1 to 3 per cord
Hay balers	3	15	7½	1 to 4 per ton
Apple graders	¼	½	¼	1 per 100 boxes
Bone grinders	3	7½	5	1.1 per 100 lb. bones
Potato graders	½	1	½	1 per 600 to 700 lb.
Cider mills	2	5	5	1 per 10 bu. of apples
Sausage grinders	¼	½	¼	4 per 100 lb. of meat
Feed mixers	3	7½	5	1 per 500 lb.

Farm Machines	Motor Horsepower Smallest	Motor Horsepower Largest	Motor Horsepower Size Most Used	Approximate Kw.-Hr. Consumption
Water systems	¼	5	½	1 to 3 per 1,000 gal. of water
Cream separators	1/10	¼	⅛	0.5 per 1,000 lb. milk
Butter churns	⅛	¼	¼	2 per 100 lb. butter
Milking machines (portable)	¼	¼	¼	Average 2.3 per cow per month
Milking machines (pipe line)	¾	3	1	
Bottle washers	⅛	¼	¼	0.5 per 1,000 bottles
Bottling and capping	¼	¾	¼	1 per 1,000 bottles
Refrigeration (dairy)	¼	15	1	25 per mo. to cool 10 gal. of milk each day
Emery wheels	⅛	1	¼	Average 5 per month for the farm shop
Drill press	⅛	½	¼	
Forge blowers	1/10	¼	⅛	
Stationary spray	1½	25	7½	70 per acre per season
Sheep shears, hp. per clipper	½	..	..	2 per 100 sheep
Vacuum cleaners	1/10	½	1/10	1 per month
Washing machines	⅛	¼	¼	2 per family per month

Make Use of the Industrial Experience of

INTERNATIONAL HARVESTER

When There's a Power Problem to Be Solved

Above: An International Model I-30 Industrial Tractor, equipped with power shovel, speeding up construction work for a public utility.

Before long the *Millionth* Tractor of International Harvester manufacture will be coming off the assembly lines and going out to handle somebody's power job. That's by long odds the biggest tractor-production figure in the industry. It is also a measure of our thirty-year experience in this field —experience which will be of value to you when you have a power problem to handle and need efficiency and economy on the job.

If your work calls for powerful crawler or wheel tractors, small tractors for cramped areas, fixed power units, small engines or motor trucks — call on a branch or authorized industrial dealer in the International Harvester sales-service organization.

Vast numbers of successful installations of International Tractors, Power Units and Motor Trucks, all over the land, are your guarantee that this Company will give you the soundest, most profitable answer to your own power problem. Cash in on International *Experience.* Specific information will be sent by mail on request.

The International Harvester line of industrial power includes wheel-type tractors, TracTracTors, stationary power units from 12 h. p. to more than 100 h. p. and 1½ to 5 h. p. engines for light-duty service.

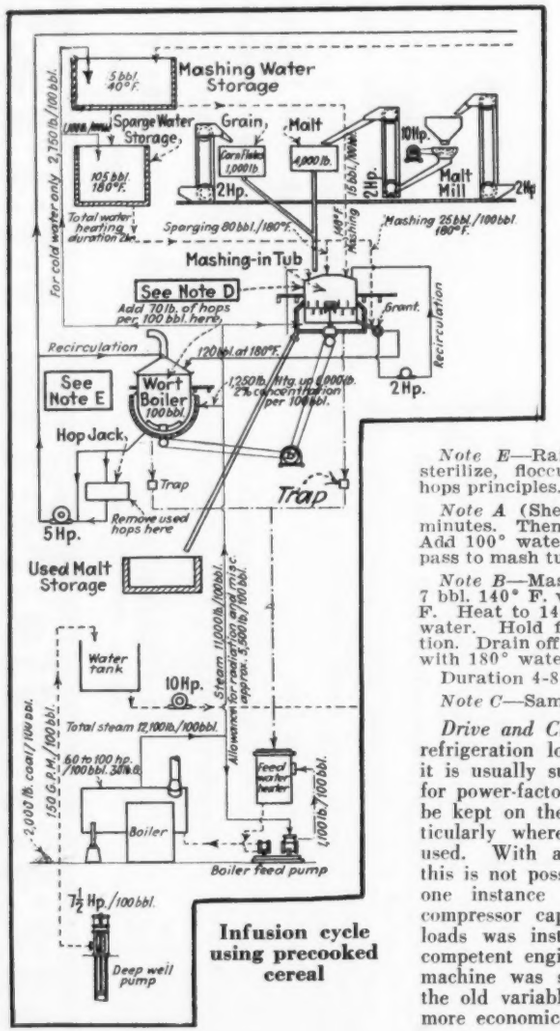
INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
606 So. Michigan Ave. Chicago, Illinois

INTERNATIONAL HARVESTER

ELECTRIFIED BREWERIES (Continued) (9)

Operations in 100-Bbl. Brew Plant With Purchased Power

(See Gilbert Wilkes, ELECTRICAL WORLD, Feb. 2, 1935)



Infusion cycle using precooked cereal

Quantities adapted from plant producing medium quality beer. Data apply to 100-bbl./brew/day. Energy consumption is 7-12 kw.-hr. per bbl. The portion to the left of the heavy dash-dot dividing line on Sheet 30 is the part which changes when the cycle involves use of precooked corn flakes. *Note D*—Mash in with 15 bbl. at 140° F. giving mash at 110° F. Heat to 140° F. by adding 25 bbl. of 180° F. water, hold for 20 minutes for saccharification. Drain off clear wort at 170° F. and sparge with 180° water. Duration 4-8 hours.

Note E—Raise temperature to 212° F. to sterilize, flocculate, concentrate and extract hops principles. Duration 2-4 hours.

Note A (Sheet 30)—Heat to 131° F. for 15 minutes. Then heat to 212° F. for 20 minutes. Add 100° water to lower temp. to 140° F. and pass to mash tub. Duration 1 hour.

Note B—Mash cooked grains and malt with 7 bbl. 140° F. water, giving final temp. of 110° F. Heat to 140° F. by adding 25 bbl. of 180° water. Hold for 20 minutes for saccharification. Drain off clear wort at 170° F. and sparge with 180° water.

Duration 4-8 hours.

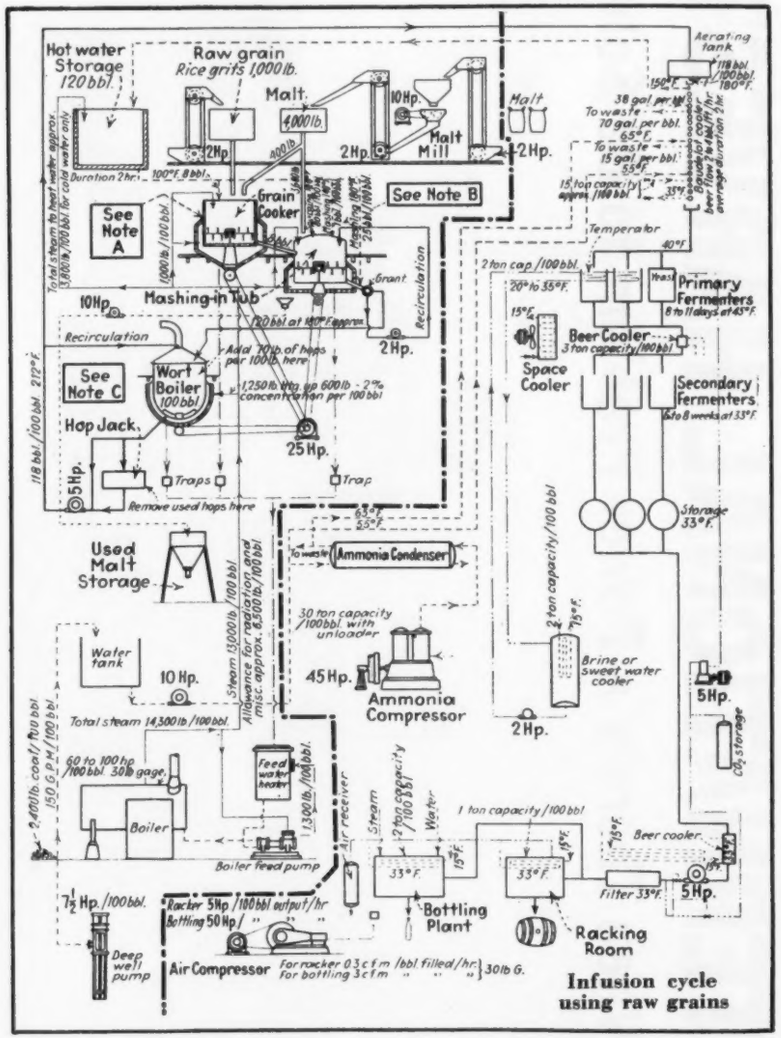
Note C—Same as Note E.

Drive and Control for Refrigeration—As the refrigeration load is the largest in the plant, it is usually supplied by a synchronous motor for power-factor correction. The motor should be kept on the line as much as possible, particularly where ratcheted reactive meters are used. With a constant-displacement machine this is not possible without wasting power. In one instance a single constant-displacement compressor capable of carrying peak summer loads was installed during prohibition, when competent engineering was not available. This machine was so large that most of the time the old variable-speed steam compressors were more economical and were operated preferably.

ELECTRIFIED BREWERIES (Continued) (10)

Operations in 100-Bbl. Brew Plant With Purchased Power

(See Gilbert Wilkes, ELECTRICAL WORLD, Feb. 2, 1935)



Infusion cycle using raw grains

SURE-FOOTED TRACTION

. . . under all road conditions because of FWD

Controlled Power

The scientific *power* and *load* distribution over front and rear wheels of the FWD Truck spells Controlled Power — power to move the truck under all conditions and proper distribution of weight to provide balanced, sure-footed traction on variable roads . . . For each driving wheel of the FWD is a worker — alive with power — with 88.2% of the engine power put to actual work . . . The FWD is the original four-wheel-drive truck—ruggedly constructed, having reserve power and embodying the highest perfection of the four-wheel-drive principle . . . It has a wider range of application, is the safest truck on the highways at high speeds, and operates economically showing definite savings in gasoline, tire wear, and maintenance costs.

Let us give you full details of FWD Controlled Power and what it means to you on your work. Write today.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory:
Kitchener, Ontario

Greater Safety The distinctive front axle location results in power, as well as load being distributed to all four wheels. This gives the FWD sure footing on slippery pavements, in congested traffic, and when going around curves.

Greater Dependability — Reserve power, rugged construction throughout, and true application of the four-wheel-drive principle insure continued DEPENDABILITY under all conditions.

Faster Service — FWDs with their powerful engines, wide range of gear ratios and four-wheel traction cut down trip-time by being able to "make the hills, curves and poor going faster than average trucks. No need to overspeed on the stretches."

Wider Range of Operation — Four-wheel traction enables the FWD to handle its regular hauling job easily and do the tough jobs as a matter of course.

Greater Economy of Operation — Definite savings are made in gasoline, tire wear, maintenance cost, and other "out-of-pocket" expenses. This is the result of equal distribution of power and load and scientific four-wheel-drive construction throughout.

FWD TRUCKS

1½ TO 15 TONS

THE SAFEST TRUCK ON THE HIGHWAY

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Integrating Element for Wattmeter

By C. E. MILLER
Testing Laboratory,
Commonwealth Edison Company, Chicago.

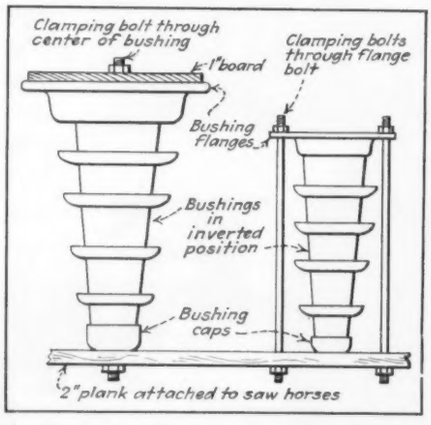
Indication of total station load is a very desirable thing in the boiler room of a steam power plant and many and various are the schemes that have been devised for instruments big enough so that their indications will be readable at the often considerable distances involved. About the simplest solution to the problem is to make the instrument just a plain, simple wattmeter responding to the station load through totalizing circuits and devices. But a wattmeter with sufficient torque to actuate the necessarily large pointer without attendant sluggishness is not so easy to obtain. A novel idea in this direction has been developed in the testing laboratory of the Commonwealth Edison Company and is being tried out in the boiler room of one of the company's stations.

The new meter, which has a circular face about 2½ ft. in diameter, is constructed of two ordinary watt-hour meter elements operating on a single disk. On account of this and because the elements operate in a horizontal instead of their normal vertical position the shaft bearings have to be somewhat revised. Thus, the addition of a retarding spring and a change in the type of damping magnets are the main structural alterations. Two elements are used because the torque of one is not sufficient for the duty. A second advantage realized by the use of the watt-hour elements is enlargement of the scale of the instrument. The usual indicating meter scale is a sector of about 60 deg., while the scale of this instrument is made 300 deg. The instrument has a face of lightly sand-blasted glass and is provided with a lamp and reflectors behind the movement. This arrangement, in conjunction with a proper light baffle, provides an evenly illuminated and easily read scale.

•

Jig for Repairing Oil Breaker Bushing

Every user of transformers, oil circuit breakers, regulators and other equipment embodying multi-part porcelain bushings finds one at some time or another with a cracked or broken petticoat that must be repaired, or the bushing cap become loose. After disassembling the bushing and removing the damaged part, a new petticoat must be cemented in place or the cap recemented. This operation requires holding the assembly rigidly while it is being cemented and until the cement has hardened. At least two methods are employed by one large utility repair shop, as shown.



Bushing clamped for cementing, rack on sawhorses

In one case the complete set of petticoats is mounted in a vertical but inverted position on a board attached to two sawhorses so it will not turn over with its top-heavy weight. In the board, at equal spacing around a circle the same diameter as the flange bolt circle, are drilled holes to receive clamping rods passing through the flange lugs. These rods are threaded at each end to receive a nut. Mounting in this position is aided by temporarily suspending the bushing from a crane hoist while the new petticoat or cap is placed in position.

When the cap has to be recemented on a compound-filled bushing the core is withdrawn and the bushing held in the inverted vertical position by a single clamping bolt passing through the center of the bushing and a board at each end.

In either case the joints are readily accessible from all sides and the cement is not so easily dropped where it shouldn't be on the porcelain. The bushings are left in this clamped position until the cement sets.

•

Simplify Calculation of Line Factors

By B. E. ELLSWORTH
Iowa-Nebraska Light & Power Company, Lincoln, Neb.

Quick and accurate determination of the physical properties of transmission lines is possible by means of the accompanying chart. The variables consist of wire size, span length, pole transverse safety factor, height of wires

The Manufacturer's Bulletin Page

KEARNEY
Hi-Line Equipment News

NEW PRODUCT INFORMATION

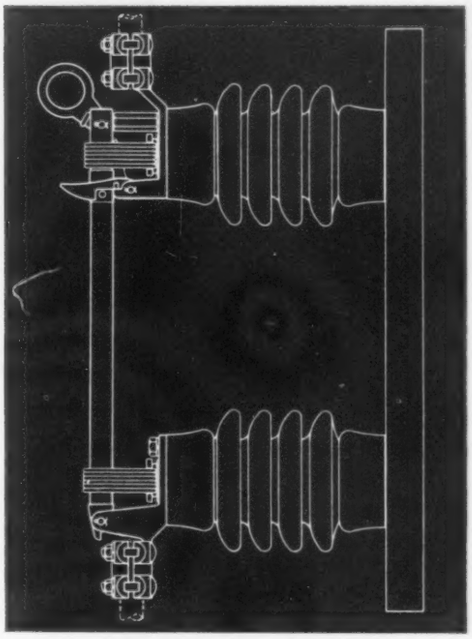
Advertising News | St. Louis, Mo., September 12, 1936 | World Copy

MULTIPLE POINT PRESSURE CONTACTS NEW DEVELOPMENT ON KEARNEY 6822 to 36 HOOK SWITCHES

Station-Post N.E.M.A. Insulators Gain Approval of Many Operators Who Are Using Them in the Field

Kearney Now Produces Fifteen Sizes of Hook Switches — Voltages 7,500 Thru 34,500 — Amperes 200 Thru 600

A RECENT addition to the Kearney line of Hook Operated Disconnect Switches are the fifteen sizes (catalog numbers 6822 through 6836) that employ the use of multiple point pressure contacts on both the top and bottom terminals. These multiple contacts, four to six on each side of each terminal, operate independently of each other and exert even pressure on the tubular blade which rests directly between each group of fingers. This logical mechanical and electrical design of contact assures positive operation, is non-corrosive, and permits breaking of ice that might accumulate from time to time.

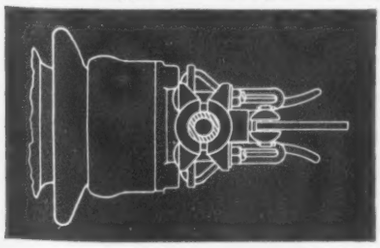


Diagramatic side view of Kearney Hook Operated Disconnect Switch.

The switch blade is copper tubing of a size in accord with the latest N.E.M.A. specifications for current carrying capacity. The temperature rise of the switch is well within the limits as specified by the Switchgear Standards.

Numerous Features

Ease of operation; a positive locking device that is interconnected with the pulling eye and automatically starts the blade out of its contacts; line connections can be made for either conductor, copper tubing or flat bus bar; contact castings of high grade bronze and drilled on 3-inch bolt circle centers to receive N.E.M.A. Standard Insulators and adaptability of the switch for either vertical or underhung mountings are features of this new switch that appeal to many operating men.



End view of the switch showing position of contact fingers.

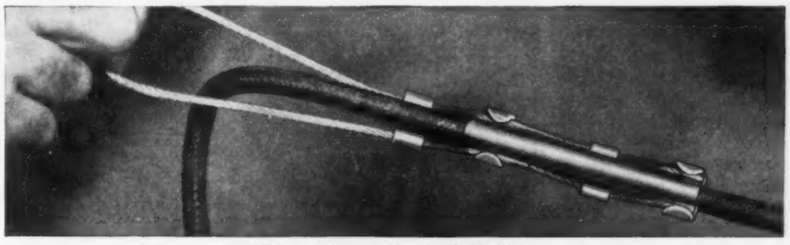
Inexpensive Service Cable Grip Holds Tight — Will Not Damage Insulation

No slippage, no marring of insulation, convenient installation — even on continuous cable—salvageability and adaptability of attaching the bail to a wire holder on the rod of a secondary rack are features of this new Kearney Service Cable Grip which is now available at low cost.

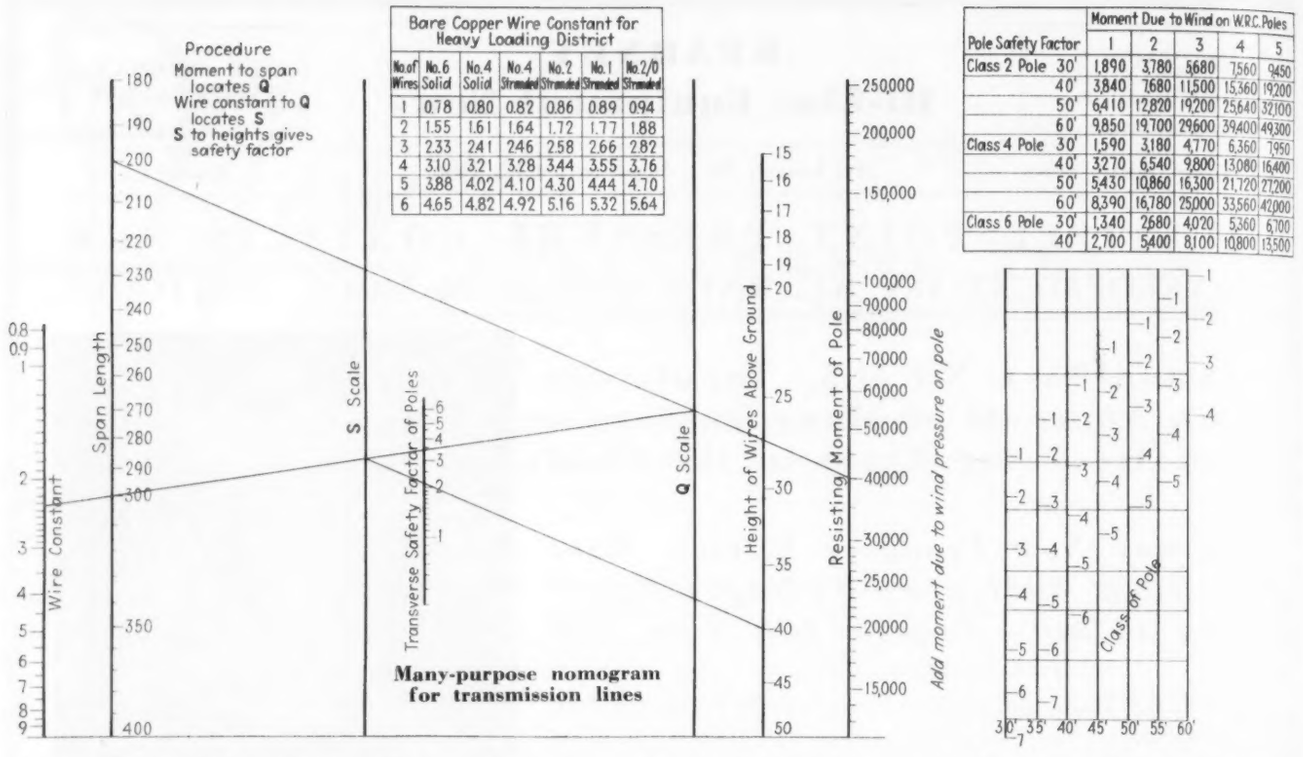
It is designed for use on multiple conductor service cable and makes an excellent means of dead-ending even under strains which would ordinarily produce damage on the braid sheath insulation.

Installation is conveniently made by lacing the bail through two grip plates which under pull or vibration automatically adjust themselves into a tight grip position. A sample will be sent on request.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave. **St. Louis, Missouri**



The new Kearney Service Cable Grip.


Procedure
Moment to span locates Q
Wire constant to Q locates S
S to heights gives safety factor
Span Length
Wire Constant
S Scale
Transverse Safety Factor of Poles
Q Scale
Height of Wires Above Ground
Resisting Moment of Pole
Add moment due to wind pressure on pole
Class of Pole
Many-purpose nomogram for transmission lines

Bare Copper Wire Constant for Heavy Loading District

No. of Wires	No. 6 Solid	No. 4 Solid	No. 4 Stranded	No. 2 Stranded	No. 1 Stranded	No. 2/0 Stranded
1	0.78	0.80	0.82	0.86	0.89	0.94
2	1.55	1.61	1.64	1.72	1.77	1.88
3	2.33	2.41	2.46	2.58	2.66	2.82
4	3.10	3.21	3.28	3.44	3.55	3.76
5	3.88	4.02	4.10	4.30	4.44	4.70
6	4.65	4.82	4.92	5.16	5.32	5.64

Pole	Safety Factor	Moment Due to Wind on W.R.C. Poles 1	2	3	4	5
Class 2 Pole	30'	1,890	3,780	5,680	7,560	9450
	40'	3,840	7,680	11,500	15,360	19,200
	50'	6,410	12,820	19,200	25,640	32,100
	60'	9,850	19,700	29,600	39,400	49,300
Class 4 Pole	30'	1,590	3,180	4,770	6,360	7,950
	40'	3,270	6,540	9,800	13,080	16,400
	50'	5,430	10,860	16,300	21,720	27,200
	60'	8,390	16,780	25,000	33,560	42,000
Class 6 Pole	30'	1,340	2,680	4,020	5,360	6,700
	40'	2,700	5,400	8,100	10,800	13,500

above ground and class of pole. The chart is reversible so any two variables may be used as a starting point.

The wire constants given are for bare copper. If ACSR or TBWP or copper for other than heavy loading are to be used secure transverse constants from the National Electrical Safety Code. The class of pole applies to S.Y.P. and W.R.C., although the table of wind pressures on poles is for W.R.C.; pressure on S.Y.P. is less.

The method of using the chart can best be shown by an example: A three x No. 2 bare copper and a three x No. 4 bare copper circuit are to be placed on 45-ft. poles with 225-ft. spans with safety factor of 2.5. What class pole will be required?

The circuits will be 38 and 32 ft. above ground respectively. Place straight edge between 38 ft. height and 2.5 safety factor and extend until it cuts the "S" scale. The wire constant for three No. 2 wires is 2.58 (from table). From 2.58 through the point on the "S" scale locate a point on the "Q" scale. From the 225-ft. span length through this point on the "Q" scale gives a resisting moment of 55,000 lb. ft. required for the pole. Similarly for the three No. 4 wires gives a moment of 43,000.

From the table of wind pressures a moment of approximately 11,000 lb. ft. is found for a 45-ft. pole, safety factor of 2.5 and class 4 pole (which is an estimated pole size). Adding 55,000, 43,000 and 11,000 gives 109,000 lb. ft. the pole must carry. To the right of this value on the "moment" scale under 45 ft. length indicates that a Class 3 pole will be required. This procedure obviously is much simplified for a one-circuit line.

•

Simple Scheme Used to Measure Services

By ROBERT R. HAMMER
Engineer
Public Service Commission of Pennsylvania, Allentown, Pa.

In distribution system field inventory work where the company requests the measurement of each house service it is often impossible to use the tape due to buildings and structures between the tap-off point and the house bracket. This condition occurs quite frequently in the built-up areas and business districts of cities and towns.

A method for estimating service lengths that was used to advantage in a recent field inventory in Pennsylvania employed a compact table of hypotenuses which fitted into the field books covering the range of angles from 25x40 ft. to an angle of 110x205 ft. in steps of 5 ft. on either side of the angle. This table is reproduced below.

25 x 40 - 47	30 x 40 - 50	35 x 40 - 53	40 x 40 - 57	45 x 45 - 64	75 x 75 -106	80 x 80 -113	85 x 85 -120	90 x 90 -127
25 x 45 - 51	30 x 45 - 54	35 x 45 - 57	40 x 45 - 60	45 x 50 - 67	75 x 80 -110	80 x 85 -117	85 x 90 -124	90 x 95 -131
25 x 50 - 56	30 x 50 - 59	35 x 50 - 61	40 x 50 - 64	45 x 55 - 71	75 x 85 -113	80 x 90 -120	85 x 95 -127	90 x100 -135
25 x 55 - 60	30 x 55 - 63	35 x 55 - 65	40 x 55 - 68	45 x 60 - 75	75 x 90 -117	80 x 95 -124	85 x100 -131	90 x105 -138
25 x 60 - 65	30 x 60 - 67	35 x 60 - 69	40 x 60 - 72	45 x 65 - 79	75 x 95 -121	80 x100 -129	85 x105 -135	90 x110 -142
25 x 65 - 70	30 x 65 - 72	35 x 65 - 74	40 x 65 - 76	45 x 70 - 83	75 x100 -125	80 x105 -132	85 x110 -139	90 x115 -146
25 x 70 - 74	30 x 70 - 76	35 x 70 - 78	40 x 70 - 81	45 x 75 - 87	75 x105 -139	80 x110 -136	85 x115 -143	90 x120 -150
25 x 75 - 79	30 x 75 - 81	35 x 75 - 83	40 x 75 - 85	45 x 80 - 92	75 x110 -133	80 x115 -140	85 x120 -147	90 x125 -154
25 x 80 - 84	30 x 80 - 85	35 x 80 - 87	40 x 80 - 89	45 x 85 - 96	75 x115 -137	80 x120 -144	85 x125 -151	90 x130 -158
25 x 85 - 88	30 x 85 - 90	35 x 85 - 92	40 x 85 - 94	45 x 90 -101	75 x120 -142	80 x125 -148	85 x130 -155	90 x135 -162
25 x 90 - 93	30 x 90 - 95	35 x 90 - 97	40 x 90 - 98	45 x 95 -106	75 x125 -146	80 x130 -153	85 x135 -160	90 x140 -167
25 x 95 - 98	30 x 95 -100	35 x 95 -101	40 x 95 -103	45 x100 -110	75 x130 -150	80 x135 -157	85 x140 -164	90 x145 -171
25 x100 -103	30 x100 -104	35 x100 -105	40 x100 -108	45 x105 -114	75 x135 -154	80 x140 -161	85 x145 -168	90 x150 -175
25 x105 -108	30 x105 -109	35 x105 -111	40 x105 -112	45 x110 -119	75 x140 -159	80 x145 -166	85 x150 -173	90 x155 -179
25 x110 -113	30 x110 -114	35 x110- 115	40 x110 -117	45 x115 -123	75 x145 -163	80 x150 -170	85 x155 -177	90 x160 -184
25 x115 -118	30 x115 -119	35 x115 -120	40 x115 -122	45 x120 -128	75 x150 -168	80 x155 -174	85 x160 -181	90 x165 -188
25 x120 -123	30 x120 -124	35 x120 -125	40 x120 -126	45 x125 -133	75 x155 -172	80 x160 -179	85 x165 -186	90 x170 -192
25 x125 -127	30 x125 -129	35 x125 -130	40 x125 -131	45 x130 -136	75 x160 -177	80 x165 -183	85 x170 -190	90 x175 -197
25 x130 -132	30 x130 -133	35 x130 -135	40 x130 -136	45 x135 -142	75 x165 -181	80 x170 -188	85 x175 -195	90 x180 -201
25 x135 -137	30 x135 -138	35 x135 -139	40 x135 -141	45 x140 -147	75 x170 -186	80 x175 -192	85 x180 -199	90 x185 -206
50 x 50 - 71	55 x 55 - 78	60 x 60 - 85	65 x 65 - 92	70 x 70 - 99	95 x 95 -134	100 x100 -141	105 x105 -148	110 x110 -156
50 x 55 - 74	55 x 60 - 81	60 x 65 - 88	65 x 70 - 96	70 x 75 -103	95 x100 -136	100 x105 -145	105 x110 -152	110 x115 -159
50 x 60 - 78	55 x 65 - 85	60 x 70 - 92	65 x 75 - 99	70 x 80 -106	95 x105 -142	100 x110 -149	105 x115 -156	110 x120 -163
50 x 65 - 82	55 x 70 - 89	60 x 75 - 96	65 x 80 -103	70 x 85 -110	95 x110 -145	100 x115 -152	105 x120 -159	110 x125 -167
50 x 70 - 86	55 x 75 - 93	60 x 80 -100	65 x 85 -107	70 x 90 -114	95 x115 -149	100 x120 -156	105 x125 -163	110 x130 -170
50 x 75 - 90	55 x 80 - 97	60 x 85 -104	65 x 90 -111	70 x 95 -118	95 x120 -153	100 x125 -160	105 x130 -167	110 x135 -174
50 x 80 - 94	55 x 85 -101	60 x 90 -108	65 x 95 -115	70 x100 -122	95 x125 -157	100 x130 -164	105 x135 -171	110 x140 -178
50 x 85 - 99	55 x 90 -105	60 x 95 -112	65 x100 -119	70 x105 -126	95 x130 -161	100 x135 -168	105 x140 -175	110 x145 -182
50 x 90 -103	55 x 95 -110	60 x100 -117	65 x105 -123	70 x110 -130	95 x135 -165	100 x140 -172	105 x145 -179	110 x150 -186
50 x 95 -107	55 x100 -114	60 x105 -121	65 x110 -128	70 x115 -135	95 x140 -169	100 x145 -176	105 x150 -183	110 x155 -190
50 x100 -112	55 x105 -118	60 x110 -125	65 x115 -132	70 x120 -139	95 x145 -173	100 x150 -180	105 x155 -187	110 x160 -194
50 x105- 116	55 x110 -183	60 x115 -130	65 x120 -136	70 x125 -143	95 x150 -178	100 x155 -184	105 x160 -191	110 x165 -198
50 x110 -121	55 x115 -127	60 x120 -134	65 x125 -141	70 x130 -146	95 x155 -182	100 x160 -189	105 x165 -196	110 x170 -202
50 x115 -125	55 x120 -132	60 x125 -139	65 x130 -145	70 x135 -152	95 x160 -186	100 x165 -193	105 x170 -800	110 x175 -207
50 x120 -130	55 x125 -136	60 x130 -143	65 x135 -150	70 x140 -157	95 x165 -190	100 x170 -197	105 x175 -804	110 x180 -211
50 x125 -135	55 x130 -141	60 x135 -148	65 x140 -154	70 x145 -161	95 x170 -195	100 x175 -802	105 x180 -808	110 x185 -215
50 x130 -139	55 x135 -146	60 x140 -153	65 x145 -159	70 x150 -166	95 x175 -199	100 x180 -806	105 x185 -813	110 x190 -220
50 x135 -144	55 x140 -150	60 x145 -157	65 x150 -163	70 x155 -170	95 x180 -804	100 x185 -810	105 x190 -817	110 x195 -224
50 x140 -149	55 x145 -155	60 x150 -162	65 x155 -168	70 x160 -175	95 x185 -808	100 x190 -815	105 x195 -821	110 x200 -228
50 x145 -153	55 x150 -160	60 x155 -166	65 x160 -173	70 x165 -179	95 x190 -812	100 x195 -819	105 x800- 226	110 x205 -232

Table of hypotenuses for estimating service length

DON'T FORGET

THE *Man* WHO PUTS THEM UP

SPECIFY L-M TRANSFORMERS...

Easy to install . . . easy to inspect . . . easy to service . . . safe to work with . . . the L-M Distribution Transformer is truly a "lineman's transformer". And by reducing installation time, L-M design effects operating economies important to the construction department.

To both lineman and engineer L-M details are practical. One size hanger for all sizes of L-M Transformers. Solderless connectors. Easy-to-read stainless steel nameplates. Husky lifting lugs for easy hoisting. Write to Line Material Co., South Milwaukee, Wis., for Transformer information.

LINE MATERIAL CO.

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

Sell Conditioned Air by Photorials

Photographs plus testimonials (call the blend "photorials") are being used effectively by Houston Lighting & Power Company to push air conditioning, refrigerators and better light. The shoe merchant is shown what his fellow merchant down the street has had done to increase sales with an air-conditioned shop, or what his friend, the jeweler, or the restaurant operator is doing to whip the usual summer slump.

The ten commercial salesmen and two industrial salesmen have been provided with sales manuals with actual photographs of local installations and with statements of how these installations have pulled trade, increased efficiency, reduced maintenance, reduced selling cost, increased profits, etc.

A graphic example is shown of entire business blocks having all of the buildings air conditioned; of theaters having capacity crowds with air conditioning; of barber and beauty shops having larger patronage with air conditioning; retail shops getting more traffic and holding shoppers longer; of catering places increasing the sales check since installing air conditioning; of stores handling perishable goods increasing sales and reducing spoilage from better refrigeration, air conditioning and better lighting, including display lighting, spot lighting, etc.

A page showing pictures of the Turf Grill, in Galveston, and the Brooks System Sandwich Shop, in Houston, carries this statement: "Cool, comfortable and attractively lighted stores bring repeat patronage." A page devoted to men's stores and display windows suggests, "Show window lighting continues selling after your sales force goes home." Other slogans urge prospects to use improved lighting and air conditioning to make the business day longer, to floodlight filling stations to sell gasoline at night equal to the daytime average, to use beverage refrigerators to increase profits and drop-in trade, to inspire confidence by displaying meats and perishable foods in well-lighted and efficient electric refrigerated boxes and cases, to increase the efficiency of office workers in insurance companies and other offices where many workers are employed.

These same pictures are also used for a series of advertising folders. One series of air-conditioning folders shows actual examples of local jobs with a statement from some major executive of each firm represented. This series is mailed to 11,000 prospects, as it is reasoned that every commercial customer is a prospect for some sort of air conditioning. For lighting and refrigeration, the commercial list is broken down into 24 classifications, and folders are mailed to these lists, each folder being devoted to a specialized class of trade or a special problem. In this way there is no waste coverage.

Photographs have also been used to illustrate folders that are mailed to 5,000 selected prospects for attic ventilation. Approximately 250 of these installations have been made in Houston this season.

Customers flock to jewelry and foot shops that are summer cooled

Others say "Cool patrons are satisfied patrons," "We continually add new customers," "Our customers and our employees just love it."

•

48 Foot-Candles for Utility Office

New offices of the municipal lighting department at Taunton, Mass., furnish an outstanding example of modern illumination and architectural treatment, utilizing Holophane lenses and opal glassware for display purposes. The exterior of the building is 80 ft. wide, and its Carrara glass

"WHAT A WONDERFUL TOASTER THIS IS!"
"YES, THERE'S A WHOLE FAMILY OF WONDERFUL TOASTMASTER PRODUCTS"
AND HERE THEY ARE!
Portrait of growing family of Toastmaster Products
TOASTMASTER ELECTRIC WATER HEATER — makes efficient use of "black heat". Born 1928.
TOASTMASTER TOASTER, Domestic Type — fully automatic, with famous Flexible Toast-Timer. Born 1926.
TOASTMASTER HOSPITALITY TRAY — for brilliant informal entertaining. Born 1933.
TOASTMASTER "JUNIOR" TOASTER, Domestic Type — beautiful and efficient. Moderately priced. Born 1936.
TOASTMASTER COFFEE-MAKER, Commercial Type — perfect coffee for restaurant patrons. Born 1934.
TOASTMASTER TOASTERS, Commercial Type — in various sizes, used in fine restaurants, hotels, and dining cars. Known for several years as "Strite" Automatic Toasters. Born 1919.
TOASTMASTER WAFFLE-BAKER, Commercial Type — for restaurants that serve the best. Born 1927.
TOASTMASTER WAFFLE-BAKER, Domestic Type — for the home. Speediest of them all. First known as Wafflemaster. Born 1930.
TOASTMASTER FOOD CONTAINERS keep foods hot or cold in "TEMPERD-AIRE" (Reg. U. S. Pat. Off.) compartments. Born 1927.

Quite a family group to grow up in a few short years. Today millions of Toastmaster Products in use!

That the Toastmaster family has had such a healthy growth is, we think, due to this: We always have built the best we knew. Prices have been based on costs after the product was proved right. The result is that Toastmaster products sometimes have been scaled a little above competition, but in cost of long and trouble-free service we believe we always have given *extra* value. Evidently the public thinks so too, for they keep on buying the things we make, in ever-increasing quantities.

In appreciation we shall keep faith by continuing to build extra value into all products that appear under the Toastmaster trademark — for *your* service.

TOASTMASTER PRODUCTS

McGRAW ELECTRIC COMPANY • CHICAGO, ILLINOIS

Light pylons feature Carrara glass front

front is featured by three pylons about 26 ft. high, each containing about 3 kw. in General Electric tubular lamps. Cove panels over the doors are equipped with 1,200 watts and a main sign over the entrance, about 24x3 ft., is provided with 5 kw. in lighting. Each show window has a connected load of 6,600 watts and an average intensity of 150 ft.-candles. Glareless illumination is also provided for the interior, the main showroom on the street floor having an area of 4,300 sq.ft. and being equipped with 31 Erickson luminaires fitted with No. 765 Holophane cut refractors and two 300-watt lamps. These units are mounted about 12 ft. above the floor and furnish 48 ft.-candles at counter level. Switching enables alternate ceiling units to be cut out when desirable.

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Utility Power Yields Profit in Changeover

By L. M. DURYEE
Industrial Power Engineer
Connecticut Light & Power Company,
Waterbury, Conn.

A monthly saving of $400 in operating cost is indicated as the result of a changeover from steam to purchased power at the Elton Hotel, Waterbury, Conn., recommended after a power survey by the Connecticut Light & Power Company. This hotel formerly used a 50-kw. steam-engine-driven generator to supply d.c. at 125 volts for motors and lights in the hotel. Similarly steam was used to drive engines totaling about 60 hp. for a hydraulic elevator pump, sump pump, condensate, feed and brine circulating pumps. Two 120-b.hp. boilers operating at 100 lb. pressure supplied the steam for the engines as well as heating, laundry, cooking and service water heating requirements. The remaining load of 50 kw. was purchased at 240 and 2,300 volts. During the summer months, when no building heating was required, a motor-generator connected to the 2,300-volt bus supplied the d.c. load.

A survey showed that substantial savings could be effected by replacing all steam power with electric, eliminating the 2,300-volt motor-generator set, changing all d.c. motors to 240 volts a.c. and supplying process steam from one boiler at a greatly reduced pressure and grate area. It was also found that 35 b.hp. would be ample to supply summer process steam. Two 120-b.hp. boilers had been in daily operation supplying 100 lb. steam pressure for engines.

Cost of the complete changeover was estimated at $6,000. At the end of the first month of operation under the new schedule results as in the attached table were noted in detail as reported by the hotel management. These savings were realized in spite of the fact that one 120-b.hp. boiler was still in operation at 75 lb. pressure pending reductions in grate area and boiler pressure. An added reduction of $150 is expected in coal cost when this change is made.

Allocation of Savings From Changeover

Total investment		$5,500
First month's saving		400
Labor saved (fireman)	$100	
Reduction power and coal cost	250	
Insurance for engine flywheel	18	
Engine and boiler room supplies	32	
	$400	

The plant engineer, who receives $200 per month, previously devoted his entire time to operating the engines. He is now available for building maintenance. Thus an added $200 credit for total power supply cost should apply.

All in all, the $5,500 investment will be repaid in substantially less than eighteen months, even disregarding credit for the engineer's time. The hotel management is well pleased with the economy of the new equipment as well as the simplicity and reliability of automatic operation. The fireman who was displaced by the changeover remained on the hotel payroll until the time of his death, shortly after the change was completed.

•

Heat Jobs Not All in Industrial Plants

By H. R. STEVENSON
Detroit Edison Company, Detroit, Mich.

With the reopening of breweries the demand for potato chips has increased and the deep fat frying of potato chips is a nice application for electric heat. The fat in which they are fried should not be heated beyond a certain point because it carbonizes, and controlled electric heat will prevent this. There are now completely electrified pressing machines which can be operated as cheaply as machines heated by oil or gas fired steam boilers, and whose first cost is below that of the steam machine. They offer distinct advantages of operation in such things as shorter time to bring them up to working temperature, no fumes or excess heat in the room, and controlled heat on the head and buck.

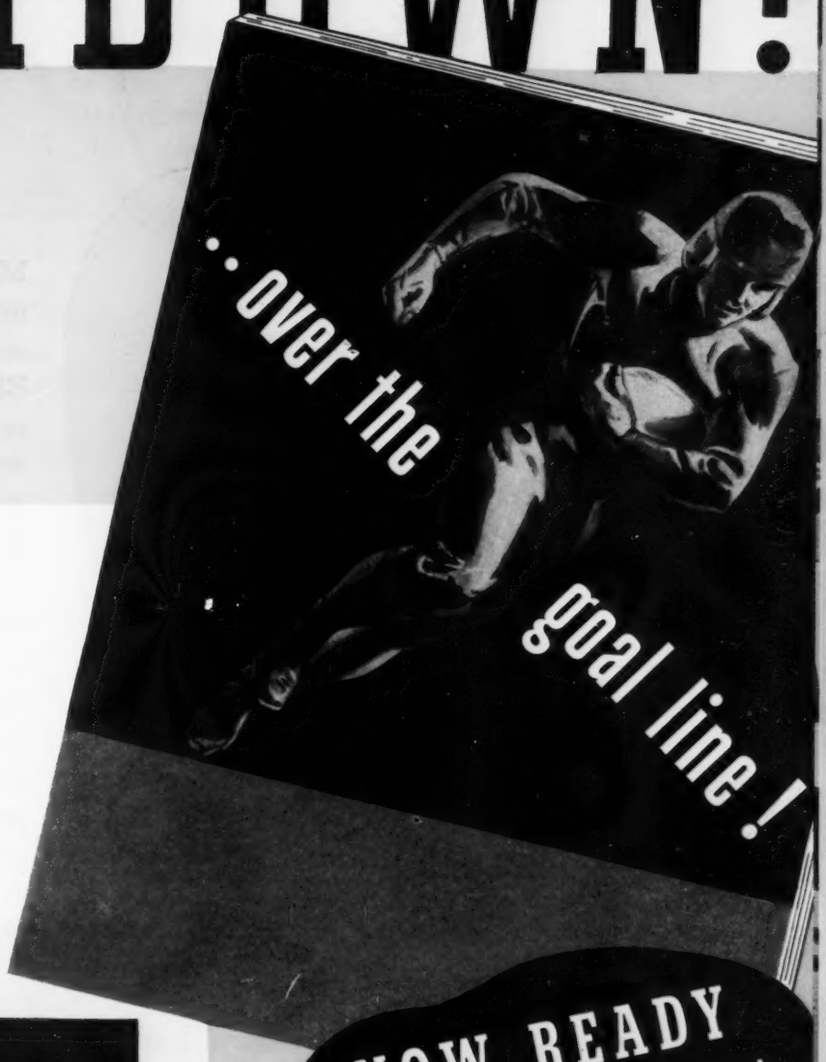
Hat cleaning shops can use a small electric boiler and heat in their blocking sand bags. Farms need heat for hot beds, incubators, milk houses and hen houses. Water heating should not be overlooked in commercial establishments, and theater ticket booths, warehouse offices, semi-outdoor markets and an isolated municipal pumping house are all prospects for space heating.

Laundries can use heat in their cabinet driers and curtain drying cabinets. Doctors, dentists and hospitals need electrically heated sterilizers, water stills and small baking ovens. Candy makers will find electric heat advantageous in many of their operations.

There is a multitude of electric heat application in places other than industrial plants.

TOUCHDOWN!

...with America's OST BEAUTIFUL LECTRIC RANGES



istory has repeated itself! The Electric range pioneer-period *is* over. Like other popular major appliances, lectric range "arrived." Already this year sales every-e have shown a sharp advance over 1935. But . . . ver the goal line with Westinghouse in 1936! Retailers Westinghouse Golden Jubilee Electric Ranges have eted sales "sky high." Here indeed is real proof that wise merchandising to play with the winner — if want profitable touchdowns. Get in the game. The inghouse Range Fall Plan Book is bulging with strategy. See it.

ifying America! Pictured here are two ghouse Ranges typical of the beautifully complete line—11 models in all — that has been winning such unprecedented favor everywhere. It will be well worth your time to learn *all* their features.

THE "ECONOMIZER" SPEED UNIT HAS CLICKED!

18% less to cook electrically! This is the everyday experience of women who own Westinghouse Golden Jubilee Electric Ranges equipped with money-saving "Economizer" units. Unparalleled cooking speed — scorching, sticking eliminated — these are other "Economizer" features that have led enthusiastic women the country over to say, "I'm glad I bought a Westinghouse Range."

NOW READY
...a startling new Plan Book

Here is a book packed with smart selling helps. New! Different! Flexible! Amazingly adapted for practically every kind of activity. Refreshing angles in sales education, newspaper advertising, direct mail, window and store displays, radio programs. All in all, the most amazingly *usable* array of sales helps and selling materials the industry has ever offered in a single plan book.

ASK TO SEE IT!

Take a look at the Westinghouse "Over the Goal Line" Plan Book. You won't put it down even after you have studied every page. Don't wait. Send your request in NOW.

MAIL THE COUPON!

Westinghouse Electric & Mfg. Co.,
Merchandising Division, Mansfield, O.

I want to see how I can go over the goal line with Westinghouse. Show me your Fall Plan Book.

Name.....
Company.....
Address.....
City..... State..... EW 9-12-36

Westinghouse

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE

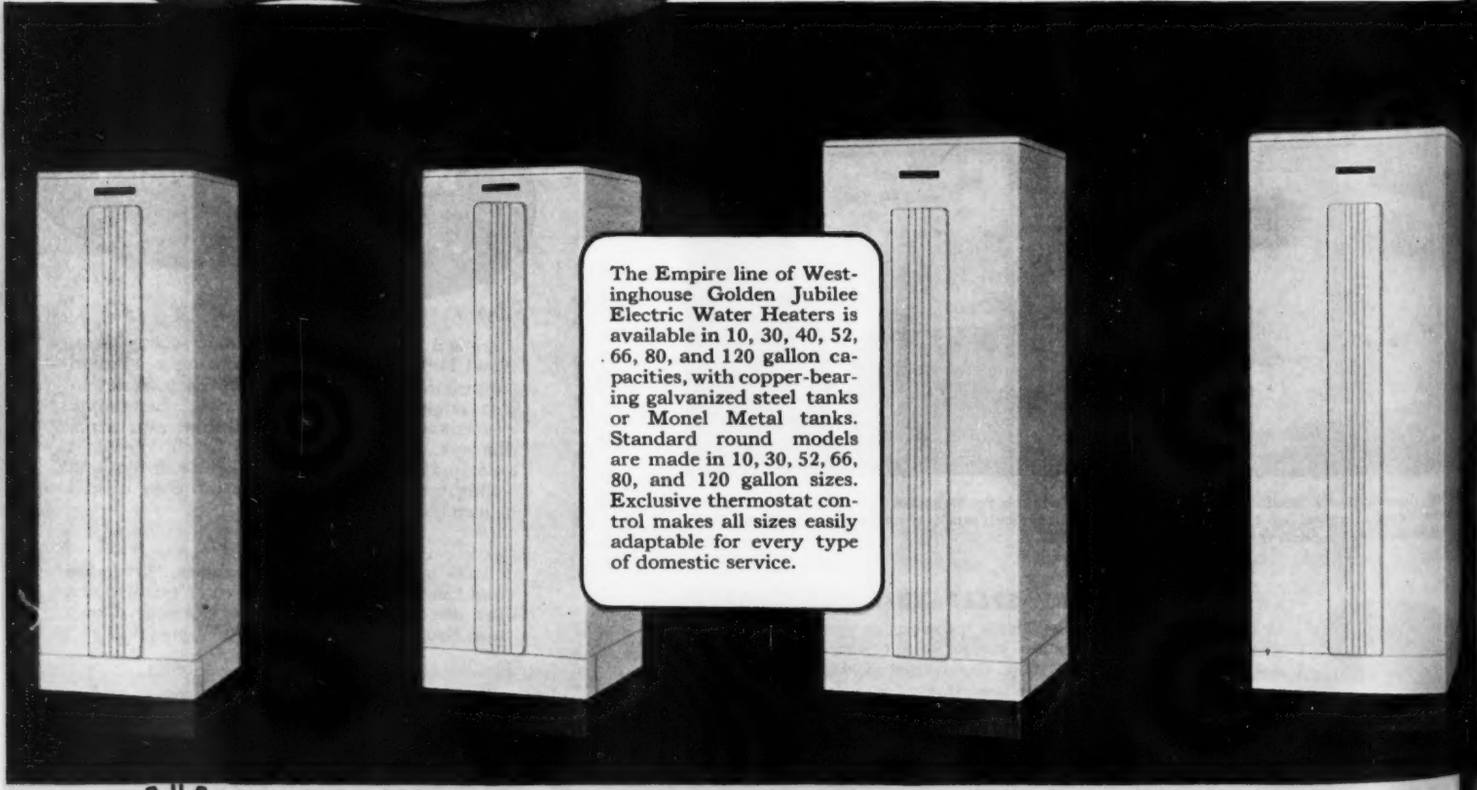
Golden Jubilee ELECTRIC RANGES

EVERY HOUSE NEEDS WESTINGHOUSE

CITED FOR BEAUTY NOTED FOR QUALITY

Miss Belle Kogan, national authority on home equi ment design, echoed the unanimous opinion of Americ women when she cited the Empire line of Westinghou Electric Water Heaters for outstanding beauty. A no wonder! These modern water heaters are beautifu styled and proportioned. They are durably finished chip-, crack-, and craze-proof white Dulux that resi heat. Designed for the homes of tomorrow, the Westi house Empire models are contributing essential beau to the all-electric kitchens of today.

But the Westinghouse Empire line is popular more than exterior styling. *Inside* engineering a construction quality have struck a new standard economical performance that has also won nation-w recognition for dependability and efficiency in all ty of service. You are urged to learn this *inside story*



The Empire line of Westinghouse Golden Jubilee Electric Water Heaters is available in 10, 30, 40, 52, 66, 80, and 120 gallon capacities, with copper-bearing galvanized steel tanks or Monel Metal tanks. Standard round models are made in 10, 30, 52, 66, 80, and 120 gallon sizes. Exclusive thermostat control makes all sizes easily adaptable for every type of domestic service.

EVERY HOUSE NEEDS WESTINGHOUSE

WESTINGHOUSE 1886 1936 GOLDEN JUBILEE

Westinghouse

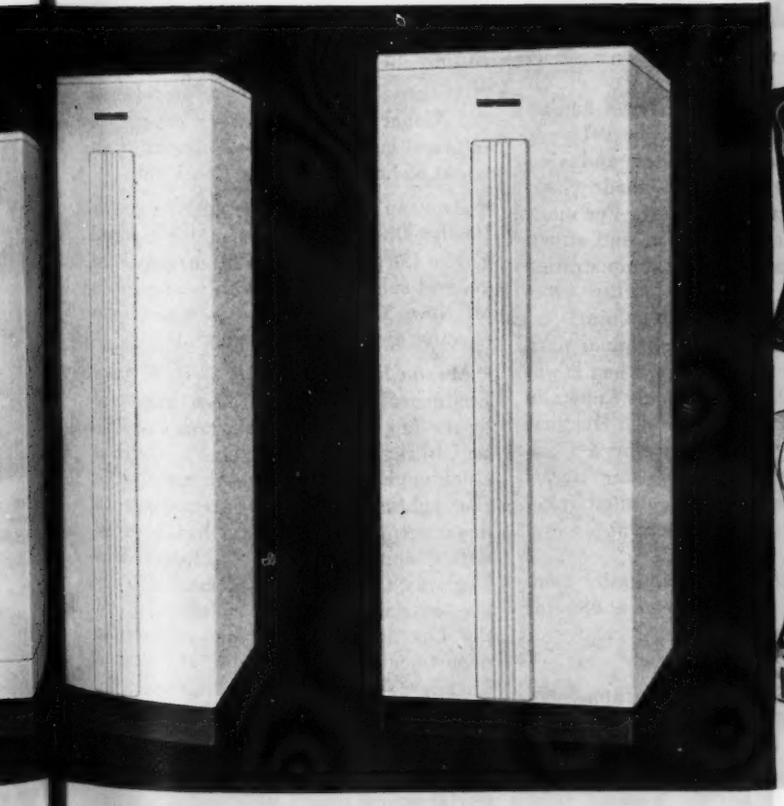
ELECTRIC WATER HEATERS

OLD FOR PROFIT!

estinghouse Electric Water Heaters—both the Em- line and the standard round models. For it is the uring, service-free *inside quality* of the entire line t has constantly pyramided reputation and profit merchants from coast to coast.

RIDE ON THIS SPECTACULAR SELLING TIDE

rchants, wise to the needs and wants of millions of erican women, have seen the Westinghouse Electric ter Heater as PROFIT MERCHANDISE, instead a "pioneer" product. As a result, up to June 1st, ir sales leaped 72½ per cent above last year. YOU share in this spectacular advance. The acclaimed uty and quality of the Westinghouse Electric Water ater are backed by the most comprehensive promo- nal program in history. Complete details are yours the asking. Mail the coupon TODAY!



Mail this Coupon

k for samples of the factful catalog . . . powerful visualizer . . . prospecting ans and contests . . . intriguing literature for all purposes . . . salesman's rary volumes . . . local advertising helps. Get the story of *your* market- portunity with Westinghouse Electric Water Heaters. The time is RIGHT ht now.

Westinghouse Electric & Manufacturing Company,
Merchandising Division, Mansfield, Ohio

Show me the big opportunity ahead with Westinghouse Electric Water Heaters. I want to see EVERYTHING.

Name .....

Company .....

Address .....

City ..... State ..... E. W. 9-12-36

News ABOUT PEOPLE

B. W. Lynch Made President of Standard Gas & Electric

Important changes in executive personnel of the Byllesby organization were announced last week when Bernard W. Lynch was elected president of the Standard Gas & Electric Company to succeed the late John J. O'Brien. In order to accept the position, Mr. Lynch resigned as director and vice-president of H. M. Byllesby & Company, with which he has been associated for many years.

Robert J. Graf of Chicago was elected president of H. M. Byllesby & Company, succeeding the late Mr. O'Brien in that position. He had been first vice-president since 1924. Joseph H. Briggs, vice-president, has been elected chairman of the Byllesby executive committee.

Action of the board of Standard Gas & Electric in electing Mr. Lynch was confirmed by the United States District Court in Wilmington, Del., where the company is in process of reorganization under Section 77b of the Federal bankruptcy act.

B. W. Lynch

The court also approved reduction in the number of Standard's directors from fifteen to twelve, as a consequence of the deaths of Mr. O'Brien, H. W. Fuller and C. L. Fisher.

Mr. Lynch has been identified continuously with the development of the Standard Gas & Electric group of utilities since 1905. His early experience was with the electrical manufacturing industry and utility operations in Chicago. He joined the Byllesby organization as an

R. J. Graf

auditor in 1905, became general auditor of Standard Gas & Electric in 1914 and in 1923 was elected director and vice-president. In 1928 he was made chairman of the finance committee. For many years he has participated in and supervised the organization, administration and financing of public utility companies, both operating and holding.

Mr. Graf was one of the original partners of Byllesby & Company, when it was founded in 1902. He is widely known in the investment banking field. His first executive position with Byllesby & Company was secretary and assistant treasurer. In 1914 he was elected vice-president and in 1924 he became its first vice-president.

Mr. Briggs joined the Byllesby company in 1909. He has been a director and vice-president since 1923.

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▶ L. G. Moore, Jr., has been appointed manager of traffic appliance sales of the G. E. Supply Corporation, with headquarters at the general office, Bridgeport, Conn. Formerly he was general sales representative for New York and assistant to H. F. Thomas, vice-president of the corporation.

Section Chairmen Named for Northwest Association

George M. Gadsby, Utah Power & Light Company, president of the Northwest Electric Light and Power Association, has announced the appointment of the following section chairmen for the current year: Accounting and business practice section, R. W. Miller, Idaho Power Company; business development section, George H. Wisting, Northwestern Electric Company; engineering and operation section, J. Hellenthal, Puget Sound Power & Light Company. He has also appointed Berkeley Snow, executive secretary, and R. H. Jones, treasurer.

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▶ Harold W. Story, vice-president of the Allis-Chalmers Manufacturing Company, West Allis, Wis., sailed recently for Europe on an extended business trip.

▶ Alfred H. Schoellkopf, president of the Niagara Hudson Power Corporation, returned last week on the *Columbus* from a tour of England and the Continent.

▶ Howard E. Eagleston, formerly Pacific District manager of the General Cable Corporation, has been appointed general sales manager with headquarters in New York. The appointment was effective September 1.

▶ Major K. Charles Bean, U. S. Army Engineer Reserves, has been appointed by the Los Angeles, Calif., Board of Public Utilities to succeed J. Ogden Marsh as chief engineer and general manager of the public utilities and transportation department. Major Bean has been assistant engineer of the California State Highway Commission and more recently was superintendent of construction for the Los Angeles municipal engineering department. He now is on the staff of Theodore Wyman, Jr., U. S. District Engineer.

▶ Adam F. Loecher has been appointed department store supervisor, household refrigeration sales, Westinghouse Electric & Manufacturing Company. Ten active years in the department store and refrigeration wholesaling and retailing

Plenty of *Rust-Free* Hot Water

when the Heater has a Tank of EVERDUR METAL—*Strengthened Copper*

Purchasers of automatic water heaters want rust-free hot water, and plenty of it . . . not for just a few years, but indefinitely. And only a tank that *cannot* rust will satisfy this requirement.

Everdur . . . the ideal metal for tanks . . . is nearly all copper, made as strong and tough as steel by a special alloying process. Yet it is immune to rust. Since it welds as readily as steel, Everdur makes possible the *economical* production of non-rust tanks by welding—the sturdiest type of construction employed by tank makers. In addition to its great strength and corrosion resistance, Everdur is highly ductile—a combination of properties which enables Everdur tanks to undergo successfully the most drastic tests.

And Everdur tanks are time-tried. Thousands of them . . . ranging in size from one to 20,000 gallons capacity . . . are in various types of service. Leading makers of automatic water heaters standardize on Everdur for rust-proof models. This quality equipment, by providing rust-free, trouble-free service, offers the public long life at low cost.

ANACONDA
from mine to consumer

EVERDUR METAL
"Everdur" is a registered trade-mark identifying products of The American Brass Company, made from alloys of copper, silicon and other elements.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

EVERDUR METAL *for* TANKS

RUSTLESS AS COPPER . . . STRONG AS STEEL

field has prepared Mr. Loecher for his new position. His responsibilities will necessitate not only his supervision of department store contacts, but will include the various phases of sales promotion, advertising and educational work in this particular field. His headquarters will be in Mansfield, Ohio.

▶ EDWARD A. HOLMBERG, who has been appliance promotion manager, Brooklyn Edison Company, since 1927, has also assumed the duties of district manager of the Pearl Street office. Mr. Holmberg has been connected with Brooklyn Edison for more than twenty-five years.

▶ BYRON H. ATWOOD has become associated with the house heating division of the Delaware Power & Light Company with headquarters in Wilmington. Mr. Atwood is well known in the United Gas Improvement System.

▶ EDWARD A. WHITEHEAD, for the past two years assistant to C. A. B. Halvorson, engineer of the lighting department, Lynn Works, General Electric Company, has been transferred to the Cleveland office of the company, where he will engage in promotional and sales activities, specializing in highway lighting.

▶ NORMAN C. NELSON, for the past four years attached to the operating and maintenance staffs of the New England Power System at Millbury and Worcester, Mass., has joined the industrial power sales department of the Worcester Electric Light Company. Mr. Nelson was engaged in construction engineering at Cincinnati, Ohio; Springfield and Pittsfield, Mass., following a master's degree in civil engineering at the Massachusetts Institute of Technology and a bachelor's degree at Worcester Polytechnic Institute.

▶ G. A. BOUVIER, formerly engineer of machining processes, Western Electric Company, Inc., Chicago, Ill., recently became director of engineering for the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

▶ E. R. SINE, assistant district engineer, General Cable Corporation, Chicago, Ill., has been transferred to the Rome, N. Y., offices of the company.

▶ B. M. CAIN, industrial consulting engineer, General Electric Company, Schenectady, N. Y., has been transferred to the Lynn (Mass.) works of that company.

▶ C. F. PRIDEAUX, formerly maintenance engineer, Municipal Light and Water Plant, Adrian, Minn., recently affiliated himself with the Northwestern Public Service Company, Huron, S. D.

▶ JOHN N. CARMODY, one of the three members of the National Labor Relations Board, has been appointed assistant administrator of the Rural Electrification Administration. Mr. Carmody was at one time editor of *Coal Age* and of *Factory and Industrial Management*, McGraw-Hill publications. He was appointed to the labor board a year ago.

WESTINGHOUSE LAMP SETS SAFETY RECORD

R. H. Beebe, superintendent of the equipment and development division, Westinghouse Lamp Company, Bloomfield, N. J., receiving from Ernest Reed (right), trustee of the Newark Safety Council, a certificate of merit for establishing a total of 1,859,891 man-hours without a lost-time accident. Fred M. Rosseland, secretary-manager of the Newark Safety Council (left), and A. W. Ross, superintendent of the warehouse and transportation division, who has already received a certificate.

OBITUARY

Norman Macbeth

Norman Macbeth, president of the Macbeth Daylighting Company and past-president of the Illuminating Engineering Society, died September 2 in Plattsburg, N. Y., in his sixty-third year.

Mr. Macbeth had specialized in the design and manufacture of equipment for the scientific reproduction of daylight. His work in this field was that of the pioneer, a number of patents, basic, mechanical and design, covering new developments in artificial daylighting apparatus having been granted to him. He was frequently retained by electric light and power and gas companies, by municipalities and by manufacturers of lighting apparatus to advise on technical, commercial and publicity matters pertaining to lighting.

Perhaps his greatest contribution to the science of illuminating engineering was the Macbeth "illuminometer," a portable photometric equipment placed on the market in 1914 for making measurements of light and illumination. Mr. Macbeth was active in the Illuminating Engineering Society since 1906 and was elected president in 1927.

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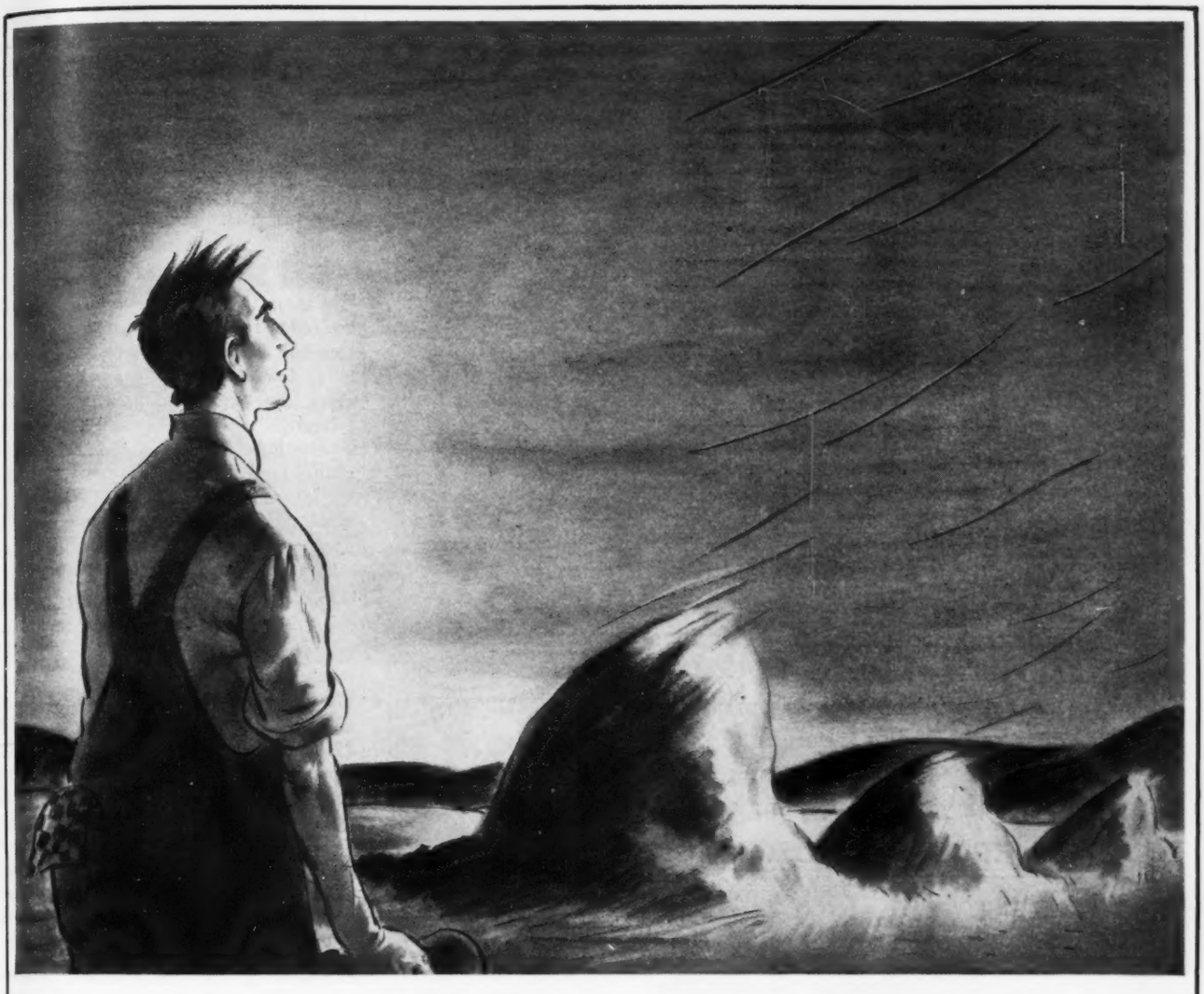
▶ CHESTER E. BLAND, an officer of the Hoosier Engineering Company, Columbus, Ohio, was recently killed by a bolt of lightning as he held a steel tapeline while at work in North Platte, Neb. Mr. Bland had been in Nebraska for almost a year, supervising electrical work on federal construction projects for the engineering company.

▶ JESSE B. MILLARD, supervisor of maintenance and construction of electrical equipment for the Hartford Electric Light Company, died August 27 at the Hartford Hospital. Mr. Millard was 55 years old and joined the Hartford company 27 years ago. Previously he had been connected with the Westinghouse-Church-Kerr Company. With the Hartford utility he did exceptional work systematizing the maintenance of electrical equipment.

▶ WILLIAM H. FRASER, general manager of the Mexican Light & Power Company, Mexico City, died August 27 in that city from a bullet wound inflicted by a discharged employee.

▶ EDWIN L. LAWTON, consulting engineer for the Manchester (Conn.) and Simsbury Electric Light Companies and formerly general manager of the Hartford Electric Light Company, died August 28, in his sixty-seventh year. While superintendent of the Hartford company Mr. Lawton was instrumental in having the old Mary Ann installed, the first steam turbine to be used in central station gen-



STRAWS IN THE WIND

AN engineer, mapping Death Valley, finds a kind of print that resists the fading action of the fiercest sun . . . a manufacturer learns how to make substantial savings by eliminating the expense of ink tracing . . . a chief draftsman discovers a machine that cuts drafting time 25% to 40% . . . an engineering record department at last obtains a vellum tracing paper that will not discolor nor grow brittle with age . . . a purchasing agent finds a single source for every engineering need.

What do these things mean? They are straws that show which way the winds of progress are blowing . . . *significant indicators of an increasing trend towards the products and processes of one company.*

That Company is the Charles Bruning Company, Inc.—leader in the fields of sensitized papers, reproduction processes, drawing material and drafting room equipment. Established in 1897, Bruning has introduced and sponsored more improvements than any other company of its kind.

Today, in the complete Bruning line, there are products and processes that can make YOUR work easier and more profitable. Bruning representatives and dealers cover the country from coast to coast. You will find it worth while to consult with them.

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Since 1897

A nation-wide service in sensitized paper, reproduction processes, drawing materials, drafting room equipment.

THIS COUPON
WILL BRING YOU VALUABLE INFORMATION

CHARLES BRUNING COMPANY, Inc., 102 Reade St., New York, N. Y.

I want to know more about the following Bruning products and processes. Please send me information, without obligation.

- ☐ Bruning Black and White Direct Printing Process
- ☐ Bruning Drafting Machines
- ☐ Drafting Furniture
- ☐ MatSurf Pencil Cloth
- ☐ Vellux Tracing Paper
- ☐ Bruning Drawing Papers
- ☐ Bruning Drawing Instruments

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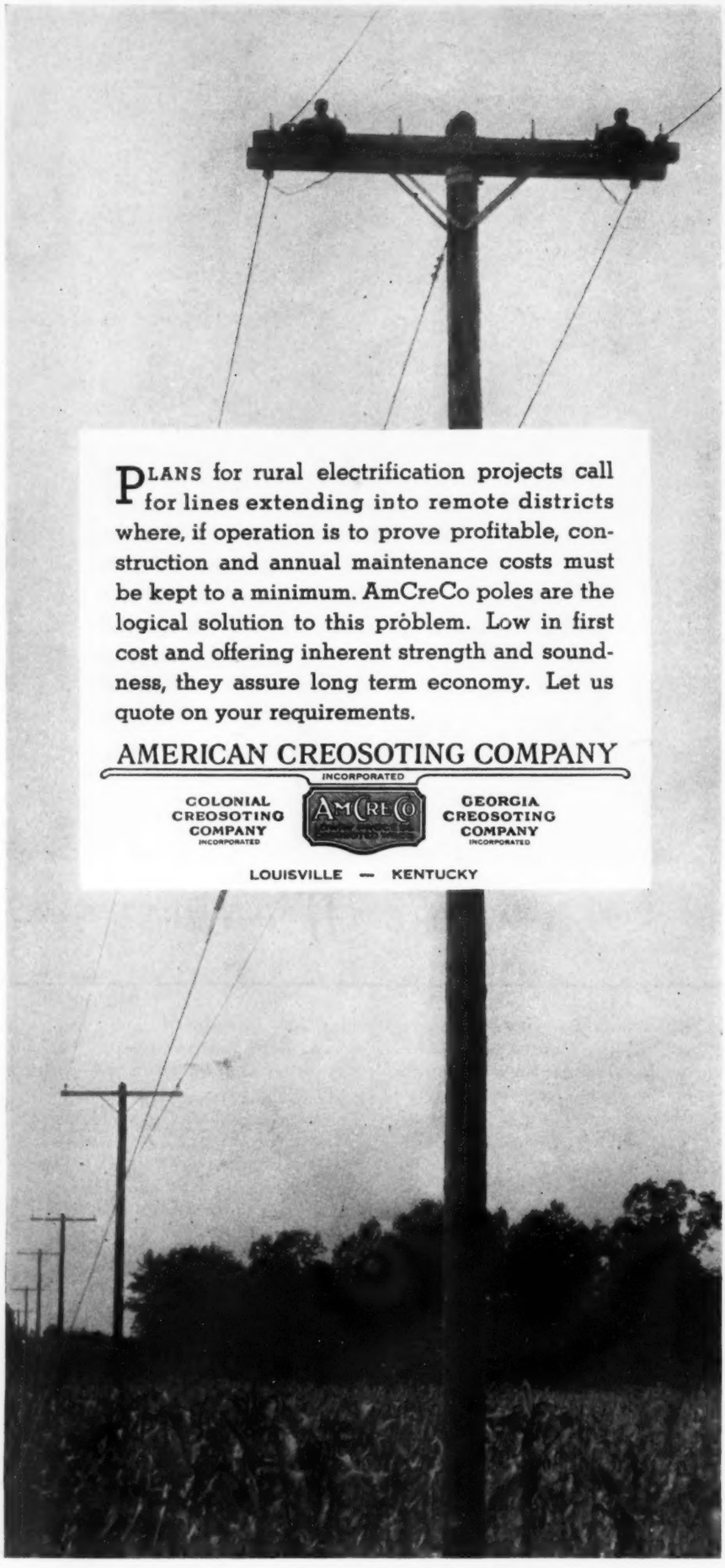
PLANS for rural electrification projects call for lines extending into remote districts where, if operation is to prove profitable, construction and annual maintenance costs must be kept to a minimum. AmCreCo poles are the logical solution to this problem. Low in first cost and offering inherent strength and soundness, they assure long term economy. Let us quote on your requirements.
AMERICAN CREOSOTING COMPANY
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LOUISVILLE — KENTUCKY

eration of electricity in the United States. Later he became interested in the underground methods of electrical distribution and gained a wide reputation for his research work in this field. Mr. Lawton was a contributor to the ELECTRICAL WORLD.

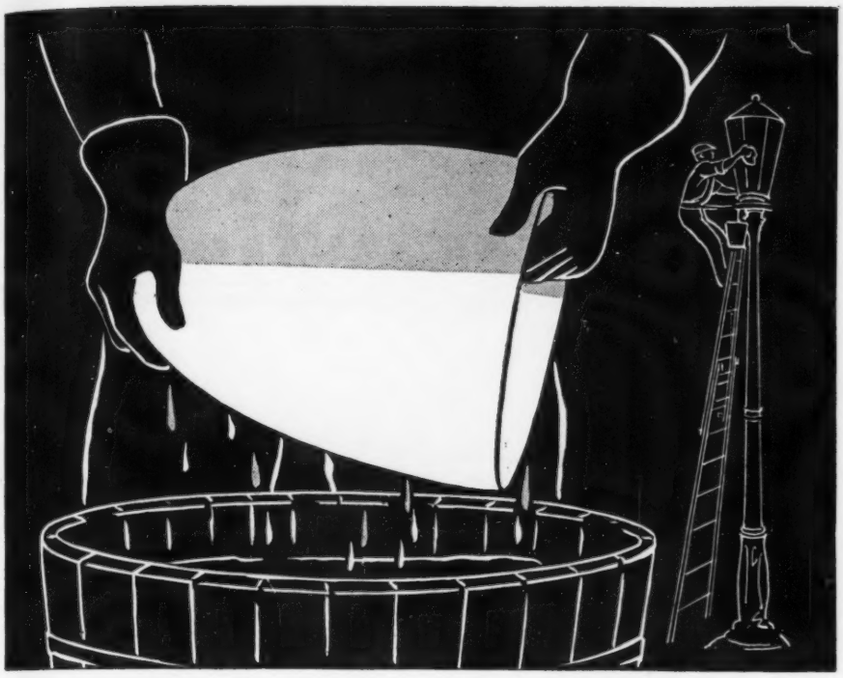
▶ HERBERT LEMMER, who was connected with the Detroit Edison Company for many years as an electrical engineer, died August 16 in his forty-first year.

▶ WALLIS C. WATSON, 49, an engineer in the federal and marine department of the General Electric Company in Schenectady, died August 28, following an operation for appendicitis. Mr. Watson joined the General Electric Company in the testing department in 1910, after his graduation from the Worcester Polytechnic Institute. From 1912 to 1916 he was employed by the government. For the past 20 years he was associated with the federal and marine department.

▶ ELAM MILLER, staff engineer of the American Telephone & Telegraph Company, died September 2, of a heart ailment, at his home in Summit, N. J., in his fifty-sixth year. Born in San Francisco, Mr. Miller came to New York in 1912 as transmission engineer for the American Telephone & Telegraph Company. He was later transferred to the office of executive vice-president and has since held the title of staff engineer of the company. He had published many articles on technical subjects and was active on various committees of the A.I.E.E.

▶ HARRY B. THAYER, formerly president of the American Telephone & Telegraph Company and Western Electric Company, New York, died September 3 in his home in New Canaan, Conn., after a long illness. He was 78 years old. Mr. Thayer entered business when the telephone was in its very beginnings and had an important part in the growth of that industry. He also played a major rôle in the development of wireless telephony and radio broadcasting. He was president of the American Telephone & Telegraph Company from 1919 to 1925, when he became chairman. He retired on his seventieth birthday in 1928.

▶ ELY EGNATOFF, treasurer of the Triad Manufacturing Company, Pawtucket, R. I., and a pioneer radio tube maker in America, died suddenly at his home in Cranston, R. I. Mr. Egnatoff was born in Russia 49 years ago and came to America in 1909. For a time he engaged in miniature lamp manufacture in New Jersey and later was an organizer of the Bright Lamp Company, Providence, R. I. In 1924 he organized the Ceco Manufacturing Company at Providence with George Coby and William Cepak, and when this enterprise was sold in 1928 the Triad company was set up.



Better Globe Cleaning *with* Skybryte

(in crystal form)

At Much Lower Cost

You can now buy Skybryte, the original glass cleaner, in *crystal form*. This means better, lower cost cleaning of Globes, Reflectors and Insulators. The advantages are obvious to any engineer who has bought liquid cleaning compounds.

1. You pay a lower price per gallon. (One pound of 2X Crystals makes 3 gallons of cleaner).
2. You save at least 75% of the freight.
3. You eliminate the nuisance of leaky barrels.
4. You eliminate a nasty storage problem.
5. The cleaner can be mixed right on the job.
6. The strength can be adjusted *exactly* to the amount of dirt on the glass.

For twenty years Skybryte has been sold on a money-back guarantee that it will make glass clean and sparkling. For twenty years Skybryte has been the leading cleaner on the market.

If you are not already using Skybryte to clean your street-lighting glass, use the coupon below to bring a free one-pound sample. It will make 3 gallons of the finest glass cleaner you have ever used.

Other Skybryte Products

RUST-TOX
For Painting Directly Over Rust

NO-GLARE
Non-glare Liquid Window Coating

The Skybryte Company
3100 Perkins Avenue
Cleveland, Ohio

Gentlemen: Please send us free of charge a one-pound sample of Skybryte 2-X Crystals.

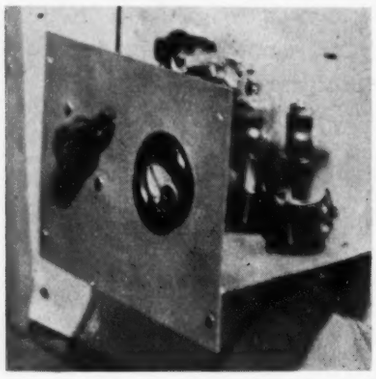
Company Name.....

Address.....Per.....

New EQUIPMENT AVAILABLE

Capacity Relay

Designed particularly for use where photo-electric apparatus may not be practical, this device is said to be especially suitable for controlling automatic doors, lights, burglar alarms, office annunicators, and the like.



"Capacitrol;" will handle non-inductive loads of 100 watts, or heavier loads with auxiliary relay; size of inclosed unit, 6½x 8x5½ in. **J. Thos. Rhamstine,** Detroit, Mich.

Necessary electrical equipment and the relay, together with an antenna—5 to 50 ft. of rubber-covered wire—are mounted in a single self-contained unit. The antenna may be run overhead or along a wall any distance up to 50 ft. and when a person or car approaches within 3 ft. of any part of the antenna the device will operate, it is claimed.

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Wax Melting Pots

Two simply-constructed wax melting pots have been announced recently. The larger is of aluminum, with steel shell and heavy steel base. Plate heater fastened to bottom and strip heater attached to the outside heat

No. 1414 wax melting pot; current consumption, 750 watts, inside diameter, 9 in., 7 in. deep; No. 1412 (not shown), current consumption 400 watts; 4 in. inside diameter, 4 in. deep. **Vulcan Electric Co.,** Lynn, Mas.

the pot. Rock wool is used to fill the space between the inner pot and the surrounding shell and base and the heating units are sealed in to prevent liquid wax from reaching them. Smaller pot is of aluminum, mounted on heat-resisting base.

•

Clock for Circuit Control

Daily automatic control of electrical circuits is said to be possible through use of a new electric clock that may be set on variable schedules. Non-magnetic housing protects against distortion of the magnetic currents driving the motor and a second-hand rotates counter-clockwise to indicate proper motor

"Little Giant" tork clock; 5,000 watts capacity for single- or double-pole service; non-corrosive materials used throughout; five plug buttons for ½-in. and ¾-in. conduit connections; weight, 3 lb. **Tork Clock Co., Mount Vernon, N. Y.**

operation. Four sections of six hours each cover an entire day's activities. Gears which run in a sealed oil chamber, rifled bearings and a centrifugal thrower to prevent oil leakage or evaporation are features.

•

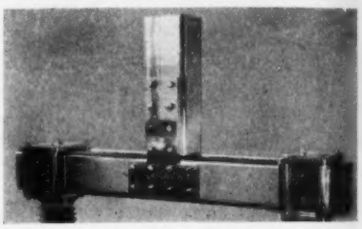
Twin-Break Relays

"Bardee" twin-break relays; single-pole, single-throw; for 110-volt, 60-cycle circuits; dimensions, 3¾x2x1⅛ in.; weight, approximately 8 oz.; magnetic wattage, approximately 4 watts. **S. L. Bartlett & Co.,** Chicago, Ill.

Twin-break wiping contacts of special high-duty alloy instead of the usual single-type are features of these new relays, designed to handle 1-kw. non-inductive or 1-hp. inductive load. It is said that these relays are absolutely silent in operation, and that their heat rise will not exceed 10 deg. above ambient temperature.

Square Copper Tube Bus

Designed to withstand heavy short-circuit stresses, this one-piece bus conductor is said



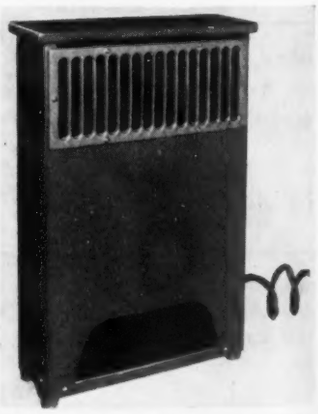
Square seamless copper tube bus; in capacities of 1,500 to 6,500 amp.; ventilated or unventilated to suit conditions. **Chase Brass & Copper Co., Inc.,** Waterbury, Conn.

to combine maximum conductivity with maximum rigidity in all directions. It can be used with standard clamps and supports, and it is claimed that fewer supports are necessary because of its strength.

•

Electric Heater

This new electric heater uses the natural rise of warm air for circulation. Air, entering the bottom of the heater, rises as it is heated by the Calrod heating units—which are cast in aluminum—and emerges from the grille at the top. It is said that the heater is completely insulated, thus permitting it to be placed against a wall.



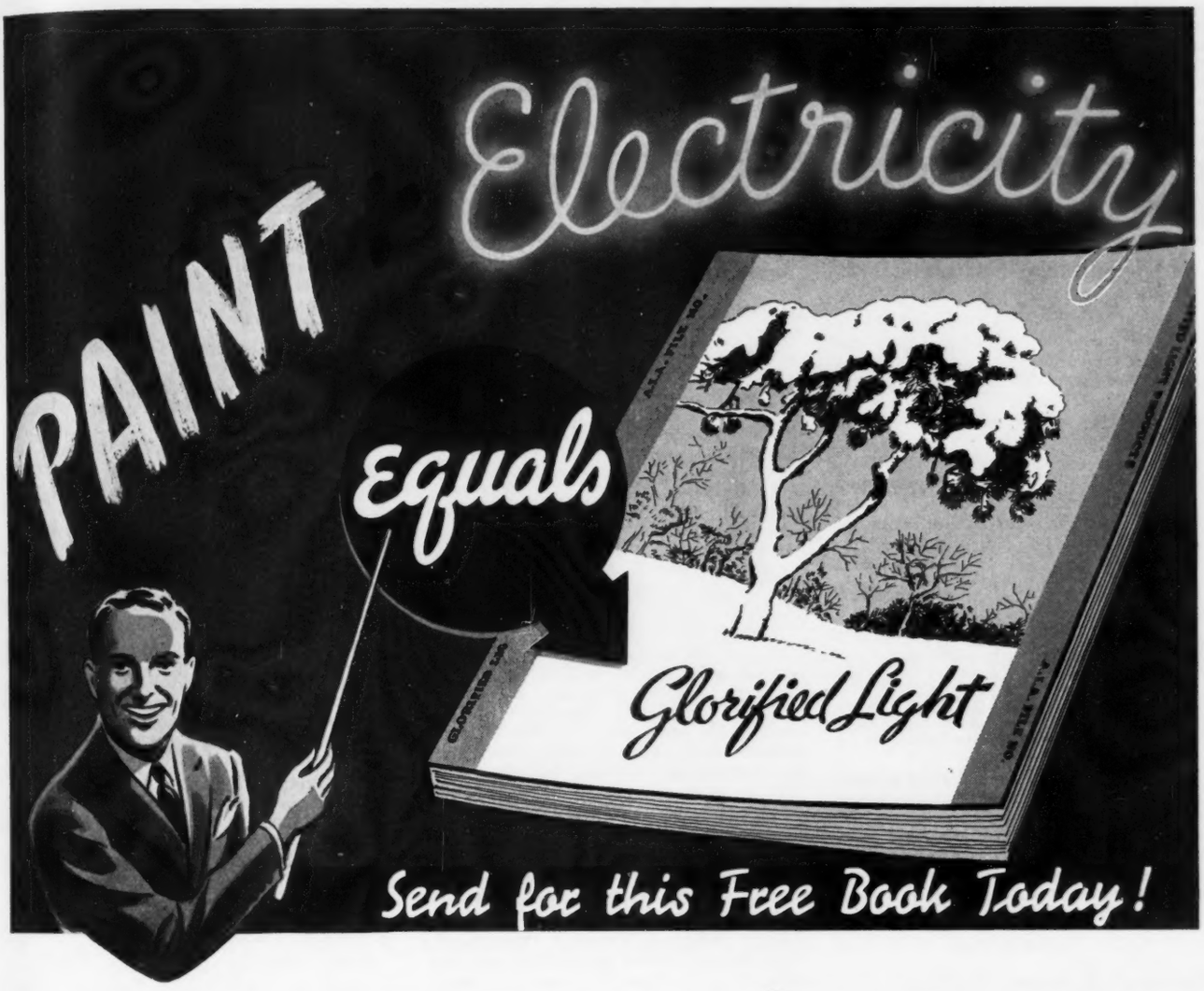
"Electromode" convection heater; rated at ¼ kw.; 4½x9½x16 in. **American Foundry Equipment Co.,** Mishawaka, Ind.

•

Frequency Source

Micromax electric control. **Leeds & Northrup Co.;** Philadelphia, Pa.

Recently announced, an electric control is said to be suitable for use as a frequency source having large power output and high



THE electrical industry's "Better Light — Better Sight" movement has disclosed some startling facts about the relation of plant lighting to employee health, accident prevention, labor turnover — and particularly to the rate and standard of production, rejection losses, tool breakage and machine efficiency.

In co-operation with this campaign, the Pittsburgh Plate Glass Company has contributed some intensive research and valuable data on the part that scientific painting plays in converting "raw" light economically into *useful* light. We call it "Glorified Light"— and the line of maintenance finishes which make this possible: *Glorified Light Products.*

The book illustrated above tells all about them and the *triple benefits* they help to effect: (1) Improved reflection and diffusion of available light; (2) Lower maintenance costs; (3) Lower production costs.

3 FINISHING SYSTEMS

The three divisions of *Glorified Light Products,* designed to meet varying plant requirements, are:

THE SNOLITE SYSTEM—a line of superior whites for all normal interior exposures. Flat, Satin, Low Eggshell, Standard Eggshell, Semi-Gloss, Gloss. Tints in Satin and Semi-Gloss.

THE SNOTEX SYSTEM—for all abnormal interior exposures except where fungus may be expected. The highest attainable resistance to discoloration in the presence of humidity, fumes, gases, heat or unusual absence of daylight.

THE FUNGUSIDE SYSTEM—for use where fungus exists or may be expected. Of special importance to bakers, brewers, distillers, cheese manufacturers, dairymen, packers and others who must wage a constant battle against bacteria, mold or other types of fungus.

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Paint Division, Dept. V-9, Pittsburgh, Pa.
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time-keeping accuracy. To serve this purpose, an electrical differential is used to check the output frequency of a motor-generator set against a frequency standard, as a tuning fork. This then operates through the electric control to maintain a time differential within one or two seconds of zero. Thus a tuning fork of high accuracy but low power output is combined with a motor-generator set having low accuracy but high power output to give the desired result.

•

Field Discharge Switch

General Electric Co., Schenectady, N. Y.

A new, manually operated field discharge switch for motor and generator field circuits, which is dead-front and mounted in back of the board, has recently been announced. These double-throw switches are made up of two single-throw switches with mechanical interlock to prevent closing both throws at one time. The direct-operating mechanism and compact construction allow minimum panel-front installation space. Tongue-type contacts with laminated blades provided with embossed line pressure contacts are used to assure efficient contact and low heating.

•

Metallic Electrical Tubing

P-M-G metallic electrical tubing and rigid conduit; conduit available in sizes from ½ in. to 4 in., tubing in sizes from ½ in. to 2 in.; all sizes furnished in 10-ft. lengths. **Phelps Dodge Copper Products Corp.**, New York, N. Y.

Bronze electrical tubing and rigid conduit has been designed for use in hazardous and corrosive locations, including gas plants and gas wells, oil refineries, distilleries, and paint works. This equipment is said to meet prescribed tests for conductivity, limited and unlimited short circuit and resistance to arcing, as well as various physical requirements.

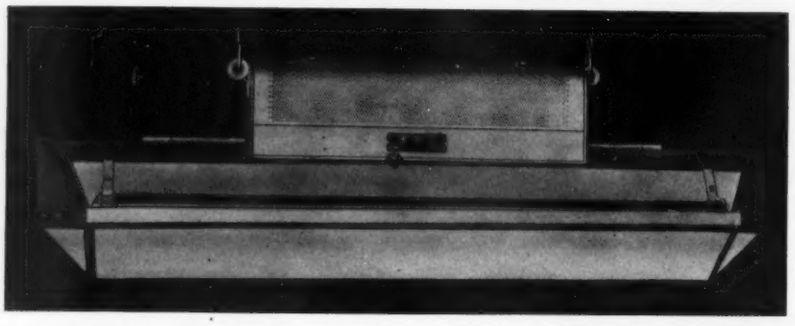
•

Thermal Release Switch

Leland Electric Co., Dayton, Ohio

Overheating protection for motors of ½ to 1 hp. that start and stop automatically is said to be provided by this thermal release switch. When the internal temperature of the motor rises above a safe value for the windings, the fusible alloy in the release is melted and, through a cam arrangement, the line circuit is broken. Device is hand-set, and the makers claim it cannot be reset as long as the solder is in a melted state.

Combination Lighting Unit



Combination lighting unit; 33 in. Cooper-Hewitt mercury-vapor tube, 1 in. in diameter, four 150-watt lamps; total output, 11,200 lumens; for operation on 110- or 220-volt a.c.; weight, 67 lb. **General Electric Vapor Lamp Co.**, Hoboken, N. J.

Recently announced lighting units combine the light from a horizontal mercury vapor source and incandescent lamps—mounted diagonally above the mercury vapor tube—to produce a light said to resemble daylight and to eliminate glaring and blinding effects even when in the direct line of vision. Their large area and even distributing characteristics make the lamps suitable for use individually in critical inspection or manufacturing operations, as well as for drafting rooms and similar locations, according to the makers.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

ALLOYS FOR ELECTRICAL PURPOSES—Book R-36 of the Driver-Harris Company, Harrison, N. J., is devoted to a complete discussion of alloys for electrical, mechanical and chemical purposes. There are suggested applications and temperature-resistance charts for the alloys—which include "Nichrome," manganin, nickel-iron alloys—current temperature characteristics of wire forms, resistance data for ribbon forms, as well as dimensions, and weights in the 68-page booklet. Additional alloys are treated briefly, and useful engineering tables make up the back pages of the catalog.

COATED RESISTORS—Wire-wound tubular resistors are discussed in Catalog No. 7 of the Atlas Resistor Company, 423 Broome St., New York, N. Y. Dimensions and ratings in watts and ohms of this line of coated resistors—both fixed and adjustable types—are furnished in the 8-page bulletin.

DUCT SEALING COMPOUND—Applications of sealing compound to sealing loaded or empty electrical ducts are pictured and described in a bulletin issued by the A. C. Horn Company, Horn Building, Long Island City, N. Y. Its use as a gasket for manhole covers is also pictured.

FLOW METERS—"Pressure Compensating Flow Meters," issued by the Foxboro Company, Foxboro, Mass., discusses these instruments. Pictures and description make clear construction details and operation of the meter, chart accompanied by discussion, compares this type of metering with the uncompensated type. Ranges and types available are also given in this 8-page booklet.

STREET LIGHTING—Bulletin GEA-2400 of the General Electric Company, Schenectady, N. Y., discusses adequate street lighting for cities, with special reference to the types of lighting needed for various sections. General recommendations for lighting both city streets and highways are given in a table, and suggestions are offered on the selection of equipment. Four types of luminaires are pictured in typical installations.

POLE TESTS—Results of tests on checked red cedar poles are shown in leaflet 65, issued by the Research Division, Western Red and Northern White Cedar Association, Metropolitan Bank Building, Minneapolis, Minn. Large checks were placed in five positions in relations to the direction of deflection under load.

PORCELAIN ENAMEL TEST—"Reflectance Test for Opaque White Porcelain Enamels" gives a tentative standard approved by the Technical Research Section of the Educational Bureau of the Porcelain Enamel Institute, 612 North Michigan Avenue, Chicago, Ill. This test specifies the manner in which reflectance may be determined, as well as the way in which this data may be applied, for both research and commercial classification.

PORTABLE CABLES—General Cable Corporation, White Plains, N. Y. has issued bulletin SS2 devoted to this line of portable, vulcanized cable. Construction features are shown and described, and complete dimensions, ratings, weights of the line, which includes standard, high-voltage, grounding, shielded and welding machine cables, are given in the 32-page catalog. Recommendations for splicing and terminating power and shovel cables are also furnished.

INDUSTRIAL LIGHTING UNITS—New "Alzak" aluminum industrial lighting units are discussed in Catalog No. 30 of the Edwin F. Guth Company, 2615 Washington Boulevard, St. Louis, Mo. Mention is made of tests carried out on the reflectors, and the line is illustrated. Specifications, dimensions, ratings and weights of these units are listed in the 8-page booklet.

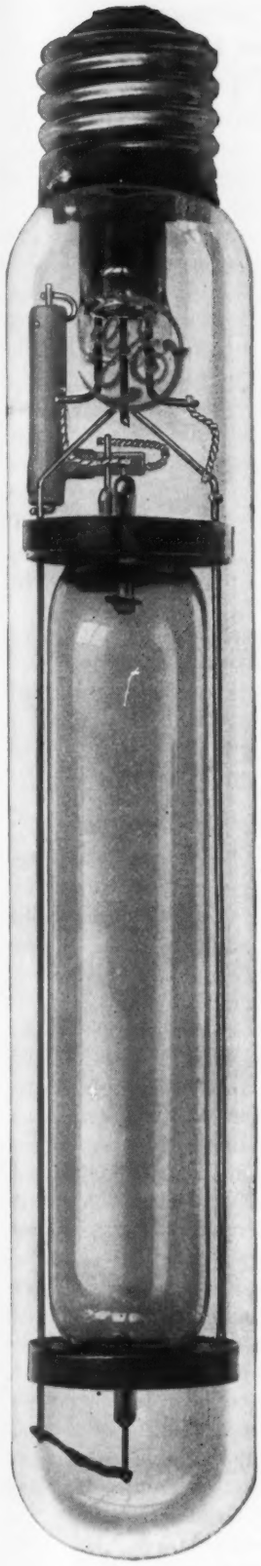
RIGID CONDUIT, ELECTRICAL TUBING—"Rustless Bronze Electrical Metallic Tubing and Rigid Conduit" is the title of a bulletin of the Phelps Dodge Copper Products Corporation, 40 Wall Street, New York, N. Y. Both physical and electrical properties of this equipment are discussed, applications are suggested and dimensional and weight data are listed. A convenient table aids in the selection of proper sizes of conduit for two- and three-wire, 600-volt systems.

DRY-TYPE, AIR-COOLED TRANSFORMERS—Leaflet 2232, issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., discusses single-phase, 60-cycle, high-voltage, 230/460-volt — low-voltage, 115/230-volt, transformers. Description of construction features, data on dimensions, weights, ratings and a schematic diagram of connections are included.

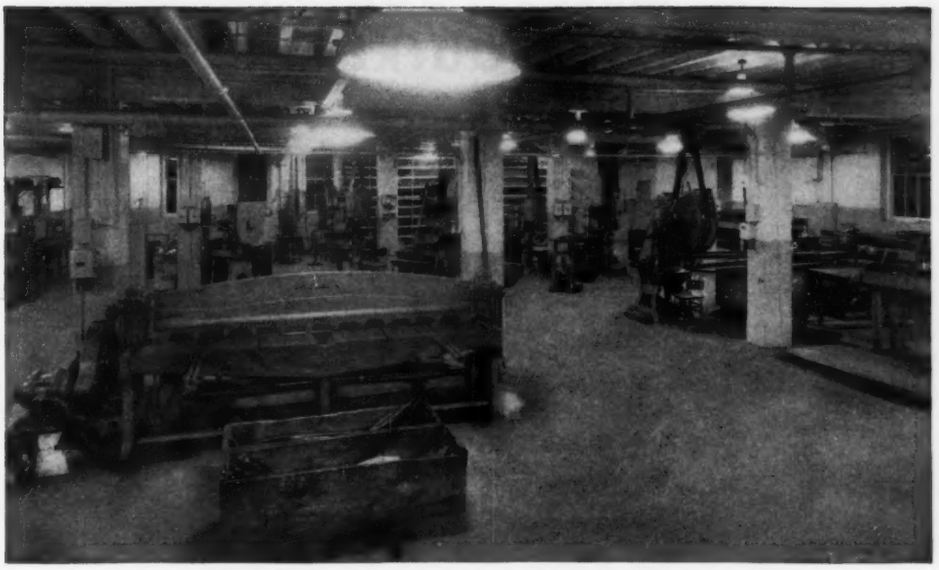
HEAT-TREATED CASTINGS—Sand-cast and heat-treated castings are discussed in a bulletin issued by the Beryllium Corporation of Pennsylvania, Reading, Pa. Data are included on the electrical and physical properties of test bars made from the Beryllium copper alloys used in these castings. Charts indicate the degree of hardness that may be obtained in these castings.

INSULATING MATERIALS—Recommendations on insulating materials for high and low temperature industrial installations are included in the Industrial Products Catalog of Johns-Manville, 22 East 40th St., New York, N. Y. Among the other industrial materials treated in the 60-page booklet are thin-walled electrical conduit and a non-impregnated asbestos insulating sheet for switchboard panels.

Double Your Productive Light



Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.



Typical installation of General Electric Mercury Lamps in a well-known press shop. The high level of general illumination makes for accurate seeing.

The 400-watt General Electric Mercury Lamp provides industry with almost double the efficiency of any other comparable light source. Long-lived, unaffected by vibration, this General Electric Mercury Lamp and its companion 250-watt lamp yield less heat per foot-candle than any other industrial illuminant. This factor is of great importance where high lighting levels with minimum extraneous heat are desirable. Psychologically, too, the light from these General Electric Mercury Lamps is cool and comfortable.

Both the 400-watt and the 250-watt lamps are adapted for use on either 115- or 230-volt lines. They have a rated life of 2,000 hours. For complete details on these lamps address the General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, New Jersey, or any of the Sales Divisions of the Incandescent Lamp Department of the General Electric Company.

GENERAL ELECTRIC

741 H

General Electric Vapor Lamp Co.
805 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Nela Park, Cleveland, Ohio

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NO MATTER what your varnished cambric tape requirements may be—no matter how exacting your specifications—Empire Varnished Cambric Tape will fully meet them.

In actual service and in the many severe laboratory tests to which it has been exposed, this tape has conclusively demonstrated its outstandingly high quality from every standpoint, including dielectric strength, tensile breaking strength, elongation, pliability, finish, uniformity, resistance to aging, and resistance to oils used in making joints and splices. There is no requirement of the central station, or of the cable or equipment manufacturer, that it does not satisfy.

We would be glad to have you put this tape to your severest test and to see first-hand evidence of its all-around excellence. Your request to our nearest office would promptly bring samples.

Empire Varnished Cambric Tape and Cloth are available in yellow or black, straight or seamless bias cut in tape form or full width materials.

Mica Insulator Company

200 Varick Street, New York; 542 So. Dearborn St., Chicago; 1276 W. 3rd St., Cleveland. *Branches at* Birmingham, Boston, Cincinnati, Los Angeles, San Francisco, Seattle. *Canada:* Montreal, Toronto.

Insulators Salvaged by Cadmium Plating

[*Continued from page 42*]

of metal, which is essential for good plating. The work to be plated is suspended on a single cathode rod midway between the two anode rods.

Current density ranges from 25 to 30 amp. per square foot for 35 minutes. This current and time have been adjusted in an effort to secure approximately one-thousandth of an inch of plate.

After plating the insulators are rinsed in a small tank of water, then rinsed thoroughly in hot water and hung up to dry. This first rinse water becomes saturated with cyanide and periodically is emptied into the main tank to make up the loss due to evaporation.

Insulators are then tested, graded, crated and delivered to the storeroom. A 5 per cent loss is sustained through plating insulators which later fail in the electrical test, but this is less expensive than double testing.

Cadmium life favorable

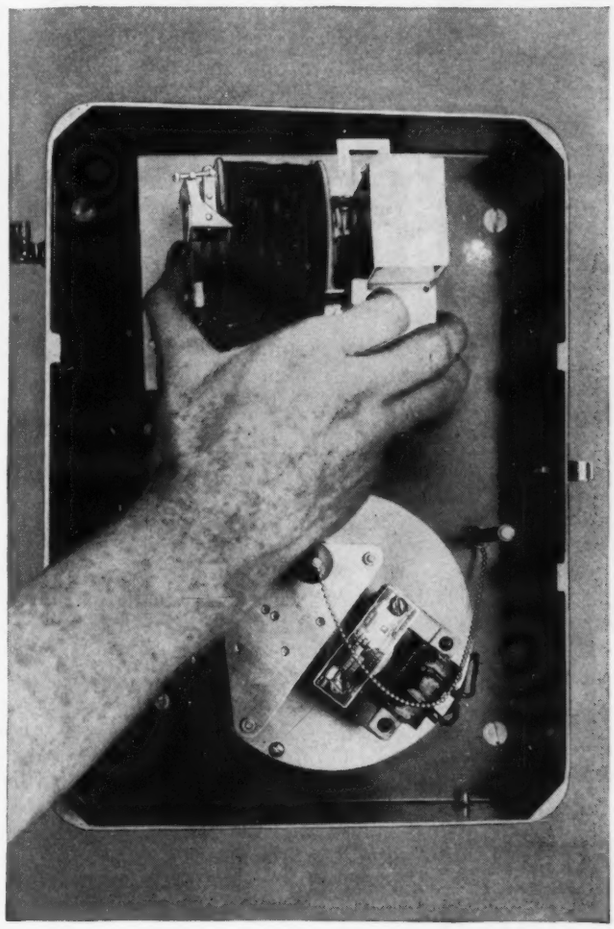
It is not expected that these salvaged insulators will last indefinitely, but present indications point to at least a reasonable length of service. Among the first insulators to be treated and placed in service were some deadends to quiet the line in the vicinity of a short-wave radio enthusiast. There have been no further complaints for more than a year, which is gratifying.

Authorities differ as to the life of cadmium as compared to hot dip galvanizing. Our experience has been limited to observations made on samples exposed to artificial weathering, and the conclusion reached is that the life of the cadmium will be from 75 to 100 per cent that of zinc. The presence of sulphur in the atmosphere, such as is found near industrial centers, would lessen the life of the cadmium to an appreciable extent. In this locality, however, the damaging agent is the salt in the atmosphere, and cadmium's favorable reaction in the presence of sodium chloride makes it possible to salvage these insulators economically.

Although difficult to estimate the savings effected in money, it is significant that the credit allowed on retired insulators has increased from 50 to almost 90 per cent of the value of a new insulator. An accurate cost record was kept on one group of 500 insulators, and the cost of salvage, testing

Change range if you want to!

you can . . . with this new round chart recorder



Movement interchangeable,—in the new Bristol's Electrical Recorder.

How often have you wanted to change the range of your ammeters! Or voltmeters! Perhaps you know of several instances in your plant right now where this could be done to advantage.

Well, with the new Bristol's Electrical Recorders you can. Movements are interchangeable,—easily, quickly, inexpensively. Just remove three screws, take out the old movement and put in a new one.

No fuss, bother, or delay. The whole thing can be done in a few minutes. And without taking the instrument out of the line.

Write for new bulletin now on press. It fully describes these *modern* recorders that you can count on for long years of good, reliable performance.

NEW FEATURES!

Moisture-proof, fume-proof, dust-proof case of corrosion-resisting aluminum alloy.

Tight fitting, rubber gasketed door.

Still greater sensitivity.

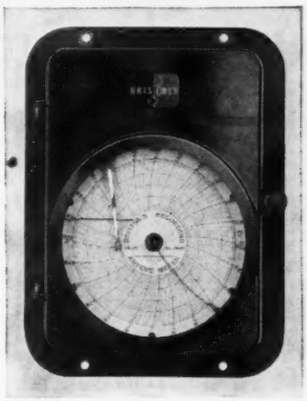
Interchangeable, sturdy yet sensitive measuring element, with safety locking device for protection during transit.

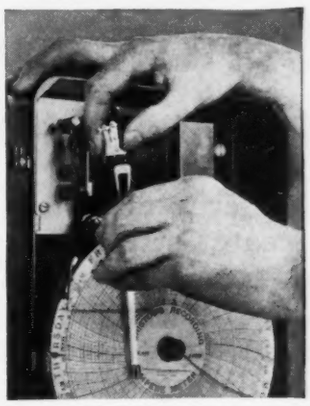
Inverted pen arm, with renewable chromium-plated tip and micrometer zero adjustment.

New "fine line" platinum point pen.

Vitreous enamel zero coefficient resistors—minimizing heating errors.

Telechron or spring-driven clock.





ABOVE—Left: **Bristol's Recording Ammeter, Single Pen, Model 640M.** Although the new Bristol's Ammeters and Voltmeters are the last word in modern electrical recorders, they possess the same simplicity, stamina, and reliability that identified the original recording electrical instrument pioneered by Bristol over 36 years ago. *Right:* Pen arm is pivoted at the top. Delicately controlled by gravity, the pressure of the pen against the chart is constant,—even though the pen arm becomes bent.

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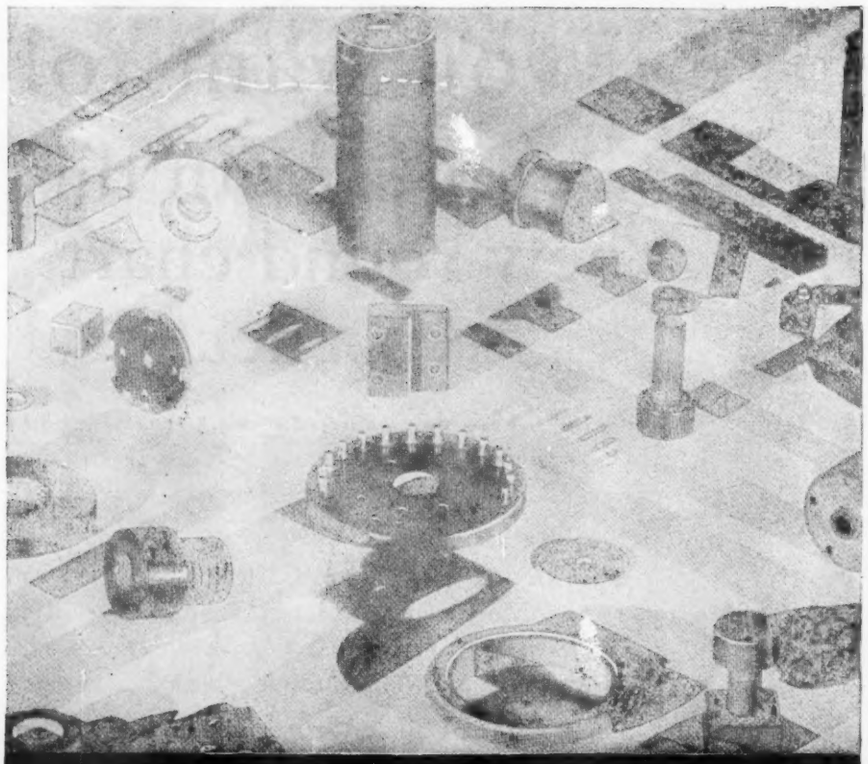

VULCOID

Use it when you need an economical non-hygroscopic insulating material

Modern electrical equipment design puts ever greater stresses on materials of construction. This is true particularly of insulating materials. As operating requirements become more severe materials must keep pace. Vulcoid is just such an insulating material. It is a product of Continental-Diamond research—developed to meet the need for a moisture resistant (non-hygroscopic) material in convenient sheet, rod and tube form at comparatively low cost.

Vulcoid is mechanically strong, light in weight, machines readily, holds formed shapes, and maintains its electrical properties. Let us send you more information, prices and samples.

CONTINENTAL-DIAMOND FIBRE CO.

NEWARK, DELAWARE

and crating amounted to about 35 cents per insulator.

Although the plant was designed primarily to salvage insulators, a large variety of articles are now plated. Overhead line switches formerly hand-buffed and then dipped in aluminum paint are now plated complete at a comparable cost. Underground cable racks and fittings, transformer hangers and miscellaneous street - lighting equipment are now plated. While the cost of plating some of these articles is somewhat higher than hot-dip galvanizing, the apparent extra cost is reduced by the fact that the nearest galvanizing plant is 125 miles away, with a resultant freight bill of double the galvanizing costs.

•

Chilean Utilities Settlement Reached

A Chilean president and a board of directors, of whom a majority will be Chileans, henceforth will administer the Chilean properties of the Electric Bond & Share Company. These properties now are grouped with the American & Foreign Power Company, Inc., which is controlled by Electric Bond & Share.

The change in management of the American and foreign utilities was demanded by the Chilean Government after it had charged the companies with breaking the Chilean foreign exchange laws and arrested their officials. In return for the concession by the Electric Bond & Share interests, the charges against the companies and their officials are to be quashed and the fines canceled.

The agreement requires that the utilities in Chile be consolidated under the management of a board of eleven directors, of whom seven must be Chileans. Six of the directors are to be appointed by the Bond & Share interests and one each are to be appointed by the Chilean Government, the Chamber of Commerce of Santiago, the Chamber of Commerce of Valparaiso and the Banco Central de Chile. The president of the company, who will be a Chilean and a director, will be elected by the vote of at least eight of the other directors.

The terms provide that of earnings applicable to ordinary shares of the Compañia Chilena de Electricidad — which henceforth is to own the Chilean utilities of the Bond & Share interests—two-thirds are to go to the Chilean Government. Of this two-thirds at least one-half is to be applied to reduce the cost of electricity to consumers. The population of the territory served by the company is estimated at 1,145,000.

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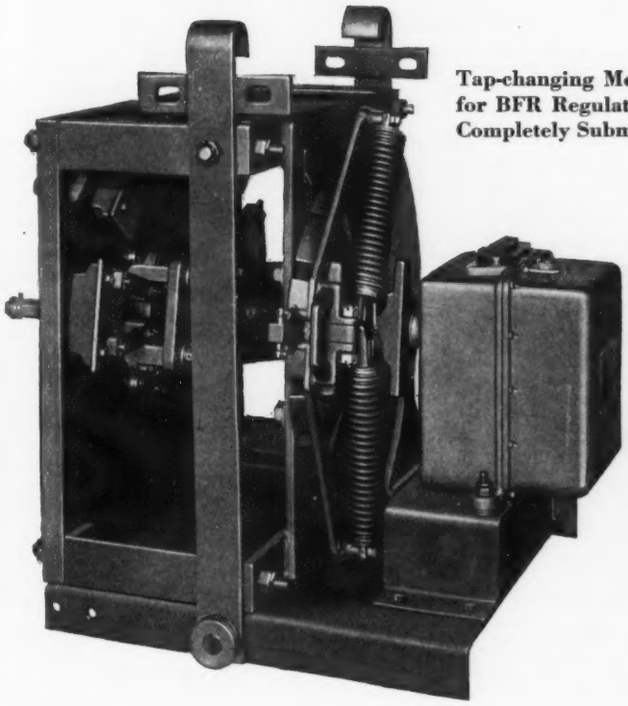
And Ask for More



Tap-changing Mechanism
for BFR Regulator—
Completely Submerged in Oil

TYPE BFR BRANCH FEEDER VOLTAGE REGULATOR . . .

With Eight 1¼% Steps

BRANCH FEEDER REGULATORS must be built to operate for years . . . on a pole . . . without inspection. To do this the tap changing mechanism must be strong and substantial and just as reliable as the mechanism in station type regulators.

The tap changing mechanism in the Allis-Chalmers Type BFR Branch Regulator is substantially the same as in the tried and proven Type AFR Station Type Regulator. It has the same large contacts of non-arcing metal. It has the same simple, substantial, positive quick-break mechanism. It has the same reliable accurate control system.

The cost has been reduced by reducing the range, the number of contacts, and eliminating some of the conveniences of station type regulators not needed for branch feeder service.

The BFR Regulator covers a 10% range in eight 1-1¼% steps. It is available in single-phase and three-phase units from 2400 to 13,200 Volts.

Ask the nearest Allis-Chalmers district office for complete information on Type BFR Regulators.

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MILWAUKEE WISCONSIN

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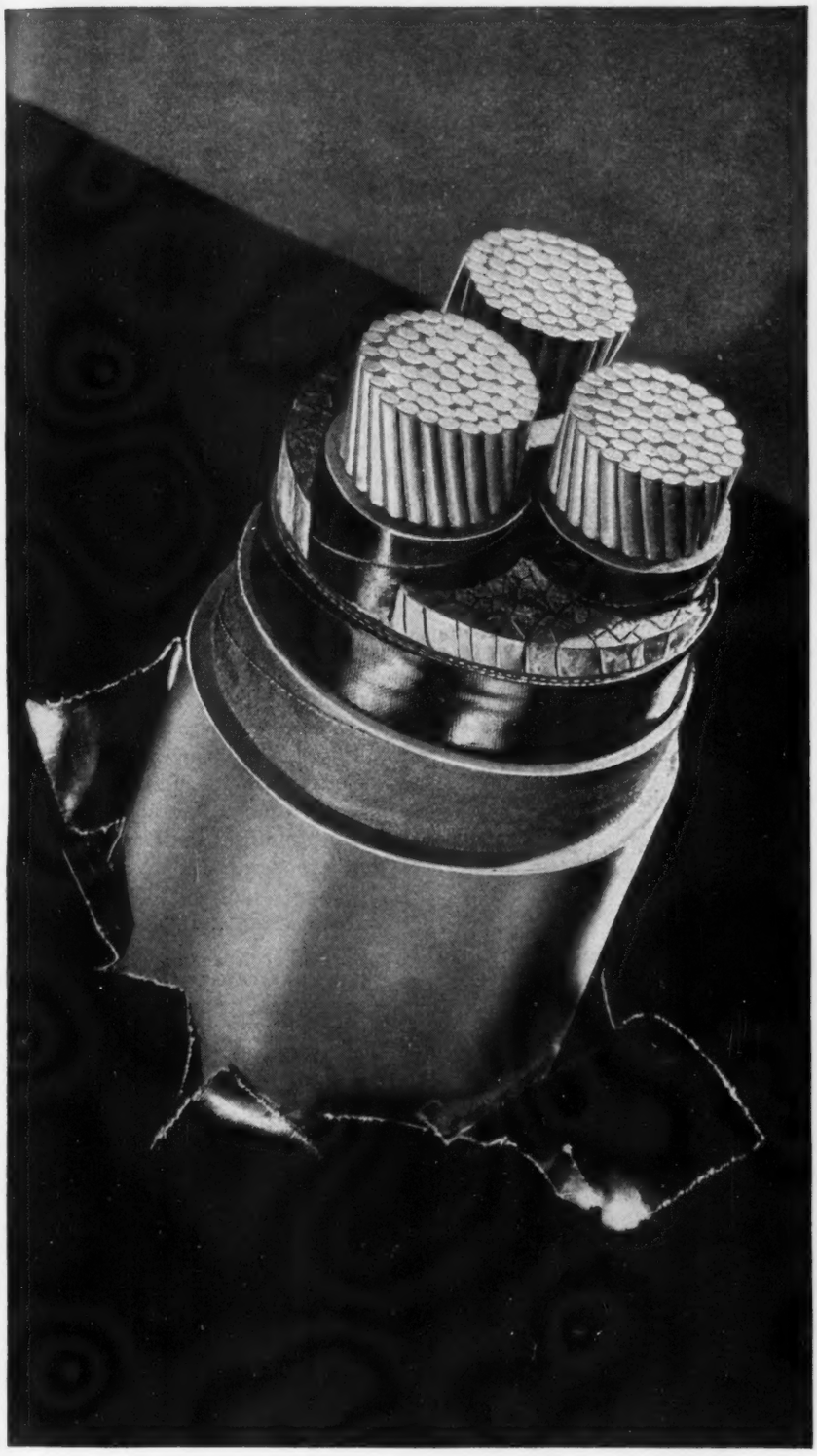
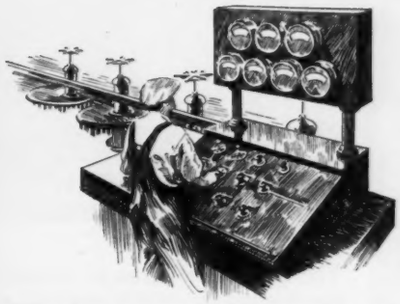


ROEBLING

Varnished Cambric Cables



Power Cable Test Panel with an ultimate capacity of 600,000 volts, one of many factory tests to which Roebling Wire and Cable is subjected.

A wealth of experience goes into the making of this fine cable. From copper to outer covering it is of traditional Roebling high quality ... the product of good materials, careful workmanship, and exacting tests.

Roebling Varnished Cambric Cable is available in single, two, and three-conductor types; for a wide range of voltages; in all commercial sizes.

Braided or leaded. Also with steel, zinc or bronze tape, or round wire steel armor.

We would welcome your inquiry for further information and prices in connection with this type of cable or any of the 60 other types at the left.

JOHN A. ROEBLING'S SONS CO.
Trenton, N. J. *Branches in Principal Cities*

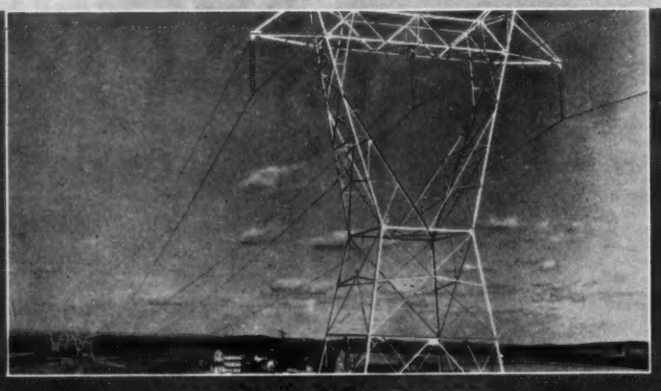
OVER 60 OTHER TYPES

Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Slow Burning Wires and Cables » Weatherproof Wires and Cables » Submarine Cables » Portable Cords » And a wide variety of other wires and cables.

TRADE MARK JAR REG U.S. PAT OFF.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

BLAW-KNOX PRODUCTS
for
PUBLIC UTILITIES



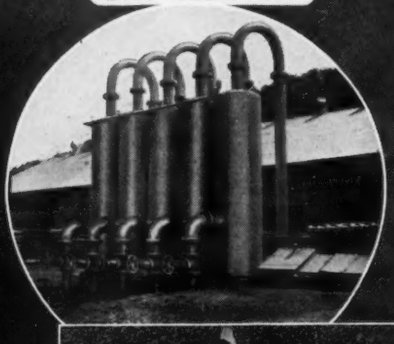
TRANSMISSION TOWERS

Thousands of miles of transmission towers . . . structural work necessitating highly specialized fabrication . . . enormous areas of Electroforged open flooring . . . standard steel buildings for all uses . . . gas cleaners for natural gas lines . . . steel forms for concrete tunnels, walls, etc. . . . steam purifiers, desuperheaters . . . clamshell buckets . . . and other products of Blaw-Knox manufacture are at work for the Public Utilities of America.

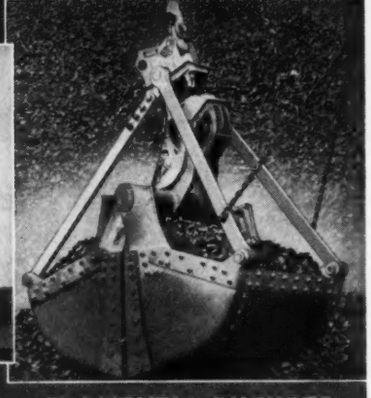
The fact that Blaw-Knox Products are in accord with the rigid standards of Public Utility purchasing is proof not only of the merit of the products themselves but of the house behind the products.

STEEL GRATING

GAS CLEANERS



STEEL BUILDINGS



CLAMSHELL BUCKETS

BLAW-KNOX COMPANY

2013 FARMERS BANK BUILDING, PITTSBURGH, PA.

Electrical Equipment in Building Construction

[*Continued from page 52*]

with the magnetic, across-the-line starter. For variable-speed pump service the slip-ring motor would be employed, but for the de-watering of excavations the use of variable speed is seldom necessary.

The finishing touches

In addition to the larger types of electrical apparatus there are a great many smaller, but still important, portable electric tools which find a wide field of use in the building construction.

In the fitting of trim, the laying of floors and the installation of woodwork the portable electric saw saves many hours of manual labor, while a similar type of tool, supplied with an abrasive wheel in place of the saw, is used in fitting and installing marble, slate, transite and other elements entering into the interior finish. This same cutter is also of much value in cutting and fitting of the fireproof tiling blocks from which many of the partitions for the rooms in a modern building are constructed.

In all building construction there are occasions for the drilling of many holes in brick, concrete and stone, holes for expansion bolts, for fastening down seats in auditoriums and theaters and for mounting all kinds of fixtures to walls and ceiling. These are readily drilled by the use of the portable electric hammer which is fitted with a star drill. For channeling concrete surfaces for the reception of conduit the same hammer may be fitted with any kind of gouging or cutting chisel that may be suited to the demands of the work.

Floors, whether of wood, mosaic or marble, must be surfaced as a final finishing operation. For wood floors the portable sander consists of a motor-driven drum the surface of which is covered with a replaceable roll of sandpaper. This is rolled across the floor by hand, back and forth, until a satisfactory finish is attained. For stone or composition floors a similar portable polisher is employed, but with the sandpaper roll replaced by a heavy polishing stone.

These portable tools are generally equipped with single-phase motors which, as they are of comparatively small horsepower, may be "plugged in" to any convenient light socket or convenience outlet.

INDUSTRIAL ELECTRIFICATION

An Editorial Highlight of

OCTOBER 24th
ELECTRICAL WORLD

MANY new electrical devices for heat, power, light, control and measurement have been developed and are being put to work in the modernization and expansion of industry.

To summarize these developments and to provide a background for industrial plant electrical planning and purchasing during the coming year, *Electrical World's* October 24th issue will present and discuss with actual installations the latest applications of electricity and electrical products to industry.

5,000 extra distribution to key power users is insured through the cooperation of power companies in leading industrial areas.

To industrial electrical engineers, this issue will be a tremendous help in further electrification work. To utility power sales engineers, it will provide a wealth of information that will be helpful in further promoting electrification by their industrial customers.

To manufacturers interested in selling the industrial market, here is a unique opportunity for profitable advertising —advertising that will put across your selling message to the key buying influences in industry.

ELECTRICAL WORLD

330 West 42nd St., New York, N. Y.

Ride the Upward Trend with Electrical World

They must improve

COMMUTATION

"YOU CAN SEE THEY'RE BETTER"

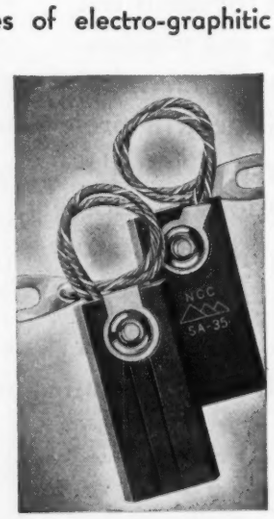
● Judgment of brush performance on commutating equipment is based on several factors, but none more important than commutation. A brush, to prove superiority, must improve commutation.

The growing popularity of the "SA" Series of electro-graphitic brushes is convincing evidence that they DO improve commutation.

The grades of this series are graduated in performance characteristics. This permits selection of the grade which will provide good all-round performance, as well as good commutation.

●

An "SA" Series Grade is not "just another brush." It is the product of a carefully planned program of research and engineering development.



There is a National Pyramid Brush for every class of service.

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices: New York Pittsburgh Chicago San Francisco

Municipal Plants

EDWARDSVILLE, ILL.—City Council is considering a city ordinance authorizing the calling of a special election on the construction and operation of a municipal light and power plant and the issuance of some revenue bonds. Approximately $216,000 in bonds would be issued. About a year ago the P.W.A. allocated a grant and loan of $393,000 for the project and recently C. H. Bauer of Chicago, Illinois P.W.A. director, asked Mayor W. C. Straube for specific information as to what the city proposes to do about the plant.

MONTICELLO, IOWA—City has granted the Iowa Electric Company a renewal of its franchise for twenty years by a vote of 793 to 97.

GUTTENBERG, IOWA—By a vote of 192 to 37 the town voted to sell its municipal power plant to the Central States Power & Light Company and to buy its electricity from the company. The distribution system will remain municipal property.

VILLISCA, IOWA—Iowa Supreme Court has again denied the plea of the Iowa-Nebraska Light & Power Company for an order to halt construction of a municipal light plant. The case has been in district court eleven times since January, 1933, and this was the fifth time it had come to the Supreme Court.

MIDDLESBORO, KY.—Board of City Commissioners has passed a resolution to negotiate for T.V.A. power. It will be necessary to pass ordinances calling a referendum on a proposition to sell a $150,000 bond issue to build a municipally-owned distribution system.

CORBIN, KY.—An expenditure of approximately $100,000 for equipment to improve the municipal power and water plant has received the approval of the city commission. The money is to be raised by issuing bonds against the municipal plant now valued at approximately $1,000,000 and debt free.

CHICOPEE, MASS.—The most substantial reduction in electric light and power rates ever given local consumers was ordered effective October 1 by the Electric Light Commission. The new schedule will result in a saving of $29,729 per year to domestic consumers, or a loss of revenue to the light department of 13.5 per cent. Commercial consumers will save $1,843 per year, while the loss in revenue from this group is 4 per cent. In the large power consuming group the savings to the consumer is $19,013 per year, with revenue loss to the department of 21.6 per cent.

POPLAR BLUFF, MO.—Board of Public Works is planning extensive improvement and additions to the municipal light plant, estimated to cost approximately $35,000. The light and water plant is now valued at $750,000, as compared with an original construction cost of $75,000. The improvements were paid for with profits from operation of the light and water system.

COLUMBUS, NEB.—Citizens approved a $250,000 bond issue for the purpose of constructing or buying a power plant. City officials are considering two propositions. Either building their own distribution system and buying power from the Loup River Public power district, or by condemnation proceedings buy the plant of the Northwestern Public Service Company.

BEATRICE, NEB.—Gage County Electric Company is circulating petitions in an attempt to have the city officials call a special election on a proposed fifteen-year electric contract between the company and the city. The company states that if such a contract were approved rates could be materially re-

duced. The city is now buying its power from Black Brothers Flour Mills which has a power plant in conjunction with their mill on the Blue River. The objectors point out that while the contract would mean a saving to the city for a few years it might be possible in the next three or four years to buy power from one of the three public power districts in the state at a still greater saving.

SARANAC LAKE, N. Y.—Campaign for construction of a $500,000 municipally owned light and power plant will be directed by a committee of five Saranac Lake business men and the question will get to the voters on October 17.

FLOYDADA, TEX.—City Council has approved the preliminary report of consulting engineers recommending the construction of a municipal electric light and power plant to cost $105,000. Plans and specifications for the proposed plant are now being drawn.

SUPERIOR, WIS.—First hearing on the proposed acquisition by the city of the Superior Light & Power Company will be held in Madison September 21, the Wisconsin Public Service Commission has announced.

DELTON, WIS.—Voters at a special referendum rejected a proposal that the town purchase the electric utility in the town from the Wisconsin Power & Light Company by a vote of 214 to 93.

•

Municipal Power Far Off at Pawtucket

Although the city of Pawtucket, R. I., has recently bought a 20-year old steam power plant from the Pawtucket Light & Power Company, of which Walter E. O'Hara, prominent racetrack promoter, is president, it is likely to be some time before local street lights and public buildings glow and hum with electricity from this former station of the Manville-Jenckes spinning mill. The plant is rated at about 5,500 kw. and has not been operated for above five years. Service has been furnished the city by the Blackstone Valley Gas & Electric Company, a Stone & Webster property, for many years, and interconnection with the New England Power Association system has proved useful throughout a long period. The plant was bought by the city for $55,000 in cash and unpaid taxes totaling $35,000 more, but to put in shape for municipal street and building service will involve further substantial costs to the taxpayers.

Last spring a bill was killed by the Rhode Island Senate which authorized a Pawtucket bond issue of $5,000,000 to acquire or build a power plant and distributing system and under which the city could have sold electricity and gas anywhere in the state. The Public Utilities Department of the state has indicated that the city appears to have the right to use the plant in its own service, but when the taxpayers awaken to the ultimate costs of the scheme the future of the project may become still more problematical.

COIL CONSTRUCTION OF WAGNER TRANSFORMERS has THESE ADVANTAGES

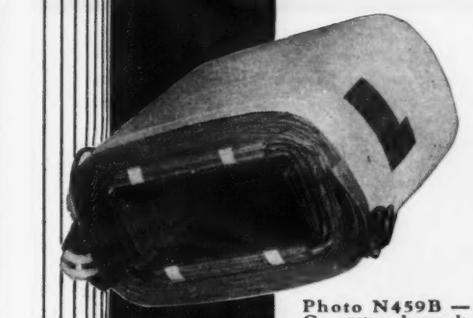


Photo N459B — *Core-type low-voltage transformer coil. 5 kva coil shown.*

Photo N207 — *View of one limb of a core-type transformer with one high voltage section removed. The high-voltage coils are wound in sections and separated by insulating washers. (See Photo F1066.)*

Photo F1066— — *One limb of a 75 kva, 6900 volt to 115/230 volt core-type transformer coil. Pressboard washers separate the high-voltage winding into sections to reduce the voltage between layers and coils.*

1. All coils are form-wound.

2. End-turns are extra heavily insulated and definitely spaced to resist line disturbances.

3. Insulating barrier used between windings consists of flexible mica, varnished muslin, pressboard, and muslin-tape, in addition to the conductor insulation.

4. Taps are brought out from the middle of the winding where they do not interfere with the surge resisting design of the coils.

5. Copper conductors are either round, square, or rectangular in cross-section, suitably insulated — depending upon the best design suitable for the kva rating and voltage.

6. Large creepage distances between the high-voltage and the low-voltage windings and between the windings and yoke iron are definitely maintained by the use of insulating strips built to the height of the conductors.

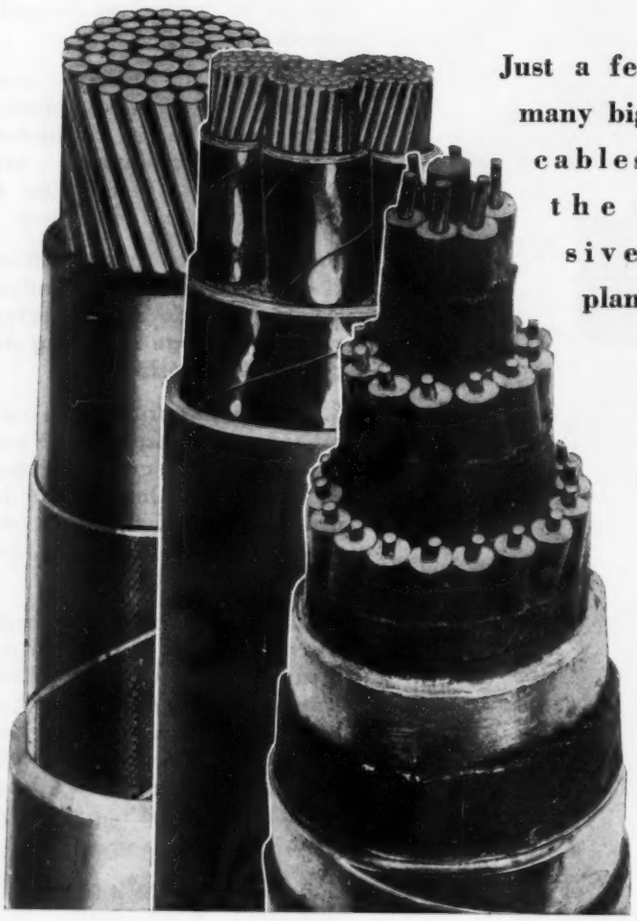
7. All finished coils are wrapped with linen tape before treating.

If you want complete "details", not only of coil construction, but also of cores, assembly, winding treatment, tanks, bushings, accessories, etc., write for Bulletin 180.

TD336-2B

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

TRANSFORMERS MOTORS FANS BRAKES



Just a few of the many big power cables made at the extensive Crescent plant.

RUBBER SHEATHED CORDS	LEAD COVERED VARNISHED CAMBRIC CABLES	FLEXIBLE CORDS
SIGNAL CABLES		WEATHERPROOF WIRE
CONTROL CABLES	PARKWAY CABLES	MAGNET WIRE

and all kinds of Special Cables to meet A.S.T.M., A.R.A., I.P.C.E.A., all R.R., Gov't and Utility Co.'s specifications.

CRESCENT INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY.

Recent Rate Changes

PACIFIC POWER & LIGHT COMPANY has reduced rates for all classes of business in ten cities served by the company in Oregon, according to an announcement made by C. W. McCulloch, public utilities commissioner of the state. Principal towns affected are Astoria, Bend, The Dalles and Pendelton. The reductions were arrived at by conference between the company and commissioner, voluntarily filed by the company and approved without public hearings by the commissioner. Cuts average 7 per cent and savings to customers annually are estimated to be approximately $100,000. In general, simplification of rate structure was achieved. For example, twelve power schedules in Deschutes County were cancelled and replaced by one schedule applicable to all classes of industrial power. In the commercial schedule the reduction was chiefly in the top steps. In residential schedules both top and bottom steps were reduced. All flat rate water heating, varying from $2 per kilowatt to $3.25 per kilowatt in different localities, has been made non-applicable to new business. All new water heating business will be taken on the 8-mill off-peak rate established some time ago.

UNION ELECTRIC LIGHT & POWER COMPANY of St. Louis, Mo., has been granted a contract to furnish the city with energy for the next ten years at a figure which is expected to save the city approximately $31,500 a year on its light bill. The contract was awarded by the Board of Public Service at the recommendation of E. E. Wall, Director of Public Utilities. The rate provided in the contract was 1.5 cents a kilowatt-hour for the first 24,000,000 kw.-hr. and at 9 mills per hour for the next 9,350,000 kw.-hr. The estimated annual light bill at these rates is $472,800 and will provide lighting for all the public streets and public buildings except those where the city develops its own energy.

SAN ANTONIO PUBLIC SERVICE COMPANY'S franchise extension has been provided for in an ordinance introduced in the city council by Mayor C. K. Quin. The ordinance which provides for a 20-year extension has been given its first reading and its final adoption is regarded as assured. The ordinance provides that the electric light and power and natural gas rates shall be reduced approximately in the amount of $415,000 a year and that the city will be paid $100,000 in cash in exchange for the extension of the franchise (ELECTRICAL WORLD, August 29, page 148). The terms of the pending franchise were submitted to C. M. Chubb, president of the utility, and approved by him. The new scale of rates will go into effect November 1. A P.W.A. project is now pending for construction of a municipal electric light and power plant in San Antonio at a cost of $10,000,000.

MISSOURI PUBLIC SERVICE COMMISSION, which recently completed a rate-base valuation of the properties of the Missouri Public Service Company, held that the $7,500,000 valuation did not warrant any decrease in the company's rates. The commission began the valuation inventory in 1932 after Nevada and Trenton has sought lower electric rates. The commission found that the utility had already made numerous adjustments in rates in various communities. Nevada consumers have asked for a rehearing by the commission claiming that the company is charging excessive rates which brought a return of 24.99 per cent on the reproduction value of its electrical properties.

HOUGHTON COUNTY ELECTRIC LIGHT COMPANY has been ordered by the Michigan Public Utilities Commission to reduce its

rates $44,574 a year. Chairman William M. Smith said that a formal order specifying the rates to be cut would be issued as soon as engineers have completed their survey.

MORROW PUBLIC SERVICE COMPANY, MOUNT GILEAD WATER, LIGHT, HEAT & POWER COMPANY and COLUMBUS, DELAWARE & MARION ELECTRIC COMPANY have been authorized by the Ohio Public Utilities Commission to establish rural optional commercial lighting arrangements in their respective territories. The rates would be 8 cents for the first 40 kw.-hr. a month, 5 cents for the next 20 kw.-hr., 4 cents for the next 140 kw.-hr. and 3 cents for all in excess, with a minimum monthly charge of $3.50.

KENTUCKY-TENNESSEE LIGHT & POWER COMPANY'S rate controversy with the city of Mayfield has been concluded by City Council. At the suggestion of City Attorney Aubrey Hester, the Council ordered the utility rates contention dismissed without prejudice. The attorney said it had been shown that rates now in force are below the basic rate for fourth-class cities, except in a few instances.

OHIO PUBLIC SERVICE COMPANY was recently granted a new 25-year franchise for operating in Elyria as well as a new ten-year street lighting contract and a new ten-year contract for the ornamental lighting system installed in the business district. A new five-year domestic rate ordinance also was passed and a new commercial rate also became effective on August 1.

CENTRAL MASSACHUSETTS ELECTRIC COMPANY has announced a revision in its commercial lighting rate D-2. This will mean a reduction of 1 cent per kilowatt-hour on the first 500 kw.-hr. per month, resulting in a reduction ranging from 10 to 15 per cent to the consumers on this rate and will also affect favorably a large proportion of the small commercial consumers now being served on rate C.

•

Air Units Installed Breaks Record

All air-conditioning records for Chicago were broken in July, according to a report to the Commonwealth Edison Company made public recently. New installations numbering 112 were reported for the month, with a total capacity of 753 hp. This is an increase of 86 per cent over the number of air cooling systems contracted for in July, 1935.

General and private offices top the list of new installations for July with a total of 50. Residences showed a substantial increase and were second with 29.

July figures brought the total number of air-conditioning systems installed or contracted for in the first seven months of this year up to 359, an increase of 47 per cent over the corresponding period of last year. Air-conditioning systems in Chicago now total 1,293.

•

Cutler-Hammer Dividend

Cutler-Hammer, Inc., has declared an extra dividend of 50 cents and the regular quarterly of 25 cents on the common stock. An extra dividend of 25 cents was paid on June 15.

Highway BODIES

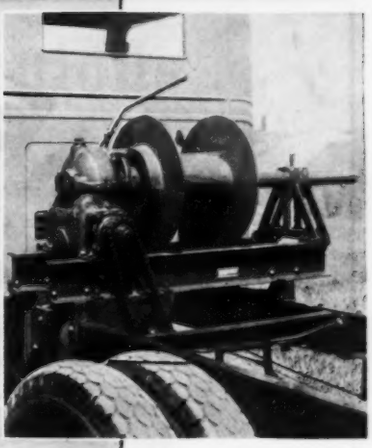
RUGGED, CONVENIENT, LIGHTWEIGHT, LONG-LIVED

Highway makes a complete line of truck bodies for Central Station line construction and service trucks. These bodies serve the widest range of utility needs—each type is designed to be light of weight yet ruggedness is built in—each type offers the utmost in convenience. These bodies are economically adaptable to today's requirements. Highway bodies have dependably served utility construction and maintenance needs for years.

Highway WINCHES

Save Costs in

TIME, LABOR, MAINTENANCE



Designed for low-cost service, there is a Highway Winch for every need with types light enough to use on 1½- and 2-ton trucks. Highway Winches are lighter and more durable, easier to use and stay in service without costly maintenance requirements. They are built with the same precision that characterizes the best in automotive equipment. Exceptionally large size housings enclosing the winch worms and worm wheels permit the use of a generous supply of oil which keeps the working parts moderately cool under the most severe working conditions.

HIGHWAY TRAILER CO.
EDGERTON WISCONSIN

Use the FERRANTI CLIP-ON AMMETER for 10 days

Free Trial

YOU are entitled to *know*—BEFORE YOU BUY—that this instrument for measuring current in AC conductors and bus bars is safe, accurate, fast and absolutely dependable.

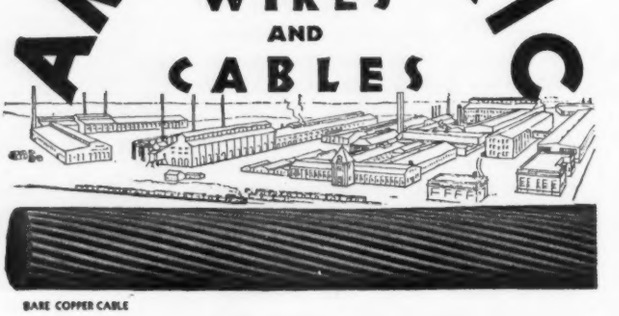
We want you to try it—without investing a penny—and prove to your entire satisfaction that the Ferranti Clip-On Ammeter offers the simplest, easiest way to take measurements on insulated or un-insulated conductors without having to open the circuit or shut down the equipment being tested.

Many others have availed themselves of this generous offer and found that the savings made have repaid the low first cost many times over. You have the same opportunity. There are no strings to our 10-DAY FREE TRIAL OFFER. Just ask us, on your letterhead, to ship a Ferranti Clip-On Ammeter for free examination and trial.

ACCEPT THIS OFFER TODAY

FERRANTI ELECTRIC, INC.
30 ROCKEFELLER PLAZA
NEW YORK, N. Y.

AMELECTRIC WIRES AND CABLES



BARE COPPER CABLE

POWER CABLE
PAPER INSULATED
VARNISHED CAMBRIC INSULATED
TELEPHONE CABLE
BARE COPPER WIRE AND CABLE
WEATHERPROOF WIRE AND CABLE
MAGNET WIRE
TROLLEY WIRE

"QUALITY ABOVE SPECIFICATIONS"

KENNECOTT WIRE AND CABLE COMPANY
SUBSIDIARY OF KENNECOTT COPPER CORPORATION
FORMERLY
AMERICAN ELECTRICAL WORKS
PHILLIPSDALE, RHODE ISLAND
New York, 100 E. 42nd St. - Chicago, 20 North Wacker Drive. - Cincinnati, Traction Bldg.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, receives bids until September 21 for 11 115-kv., and six 161-kv., outdoor disconnecting switches for switchyard at Norris hydroelectric generating station.

DETROIT, MICH.—Precision Spring Corporation, 5900 Federal Street, plans installation of motors and controls, electric hoists, conveyors and other equipment in new addition to steel spring manufacturing plant. Cost in excess of $125,000.

BARRON, Wis.—Barron County Electric Co-operative Association, recently organized, has concluded financing through Federal aid for fund of $195,000 for transmission and distributing lines for rural electrification in parts of Barron and Washburn Counties, totaling about 185 miles, with substation and service facilities. Work is scheduled to begin soon.

PORT CLINTON, OHIO—Has surveys and estimates of cost under way for proposed city-owned electric power plant and electrical distributing lines. Burns & McDonnel Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineers.

MOBILE, ALA.—Southern Kraft Corporation, Mobile, plans installation of motors and controls, regulators, conveyors, electric hoists, loaders and other equipment in new multi-unit kraft pulp and paper mill to be erected on site now being selected in Southern district. A power house will be built, as well as an electric-operated pumping station. Plant will have initial rating of 150,000 tons of finished stock per annum. Cost in excess of $1,000,000. Work scheduled to begin this fall. Company headquarters are at 220 West Forty-second Street, New York, N. Y.

PHILADELPHIA, PA.—Commanding Officer, Ordnance Department, United States Army, Frankford Arsenal, Philadelphia, receives bids until September 24 for gasoline-operated electric-generating units, a.c., in lots of 15 to 45 (Circular 71).

POPLAR BLUFF, MO.—Receives bids until September 16 for equipment for municipal power plant, including one 400-hp. cross-drum watertube boiler and accessories, stoker, feedwater heater and miscellaneous apparatus.

OIL CITY, PA.—Keystone Public Service Company, Oil City, plans transmission line over Allegheny River at point in President Township. Application has been made for permission.

BROOKLYN, N. Y.—Signal Corps Procurement District, United States Army, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, receives bids until September 28 for 900,000 feet of wire, 14,070 feet of cable, and 1,000 feet of switchboard cable, with 19 reels (Circular 37).

ONAWA, IOWA—Monona County Rural Electric Co-operative Association, A. Earl McNeill, Onawa, secretary, recently organized, plans transmission and distributing lines for rural electrification in part of Monona County, totaling about 95 miles, with power substation and service facilities. Cost about $100,000. Financing will be arranged through Federal aid. Service will be secured from local municipal power plant. A. S. Harrington, Baum Building, Omaha, Neb., is consulting engineer.

TOPPENISH, WASH.—Utah-Idaho Sugar Company, Salt Lake City, Utah, plans installation of motors and controls, regulators, transformers and accessories, electric hoists, conveyors and other equipment in new multi-story beet sugar mill on site near Toppenish. A power plant will be built for mill service.

Work scheduled to begin soon. Cost close to $750,000.

EHRENBERG, ARIZ.—Southern Sierras Power Company, Riverside, Calif., plans extensions in transmission lines in Ehrenberg district and over Colorado River at that point. Application has been made for permission.

COLUMBUS, OHIO—Board of Public Works, City Hall, receives bids until September 29 for battery of nine motor-driven centrifugal pumping units and auxiliary equipment, including control apparatus, for municipal sewage treatment works.

PITTSBURGH, PA.—United States Engineer Office, Pittsburgh, receives bids until September 25 for lift gates and gate-hoisting machinery for Emsworth Lock and Dam, Ohio River, including electric power and light distributing systems, electric control equipment and miscellaneous electric power apparatus (Circular 43).

LINCOLN, NEB.—Iowa-Nebraska Light & Power Company, Lincoln, plans extensions in transmission and distributing lines in part of Butler and Lancaster Counties for rural electrification, including service facilities. Permission has been secured.

WASHINGTON, D. C.—Quartermaster Depot, Washington, receives bids until September 24 for one Diesel engine-driven generating set, complete with auxiliaries (Circular 43).

CINCINNATI, OHIO—Clopay Corporation, York Street, plans installation of motors and controls, conveyors and other equipment in new addition to paper products manufacturing plant. Cost close to $100,000. Carl J. Kiefer, Inc., Schmidt Building, is consulting engineer.

CLARENDON, VA.—Board of Arlington County Commissioners, Frank C. Hanrahan, county manager, is having surveys and estimates of cost made for proposed county-owned electric power plant, for service at county institutions and properties. Wiley & Wilson, Lynchburg, Va., are consulting engineers.

FARMINGTON, MINN.—Dakota County Electric Co-operative Association, A. H. Gelder, Farmington, manager, lately organized, has plans maturing for transmission and distributing lines in part of Dakota County for rural electrification, totaling about 185 miles, with service facilities, increasing proposed system from 50 miles, as originally projected. Cost about $200,000. Financing is being arranged through Federal aid.

NEW YORK, N. Y.—Sheffield Farms Company, Inc., 524 West Fifty-seventh Street, plans installation of motors and controls, regulators, conveyors and other equipment in new multi-story milk pasteurizing plant at 806-30 Eleventh Avenue. Cost about $900,000.

GOVERNORS ISLAND, N. Y.—Signal Officer, Second Corps Area, United States Army, receives bids until September 28 for one telephone switchboard for fire-reporting service (Circular 3).

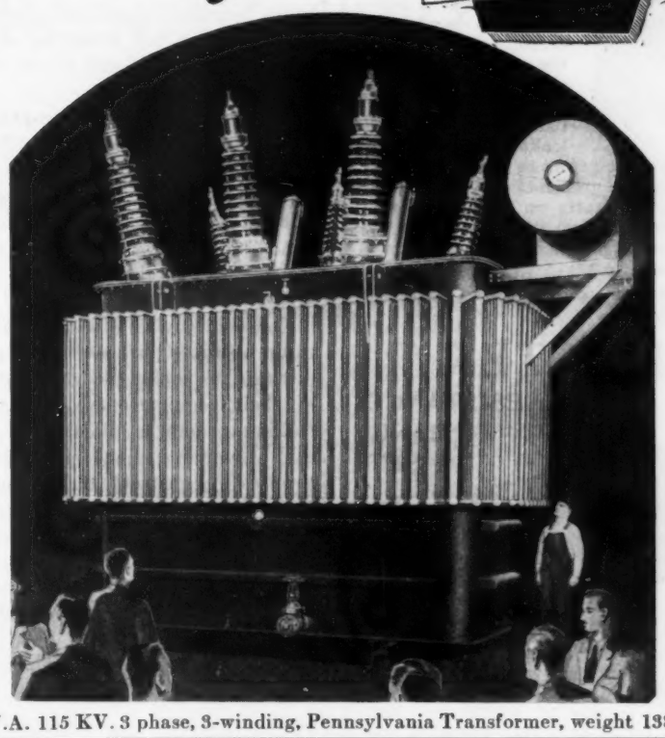
•

Weston Instrument Net Totals $101,031

For the six months ended June 30 net profit of the Weston Electrical Instrument Corporation and domestic subsidiary after depreciation, federal income taxes and other charges, totaled $101,031, equal after dividend requirements on $2 Class A stock to 43 cents a share on 160,583 no-par common shares. Net profit in first half of 1935, $74,746, or 25 cents a common share.

Before you buy...

PENNSYLVANIA TRANSFORMERS



7500 K.V.A. 115 KV. 3 phase, 3-winding, Pennsylvania Transformer, weight 138,000 lbs.

Ask these questions . . .

- Does the transformer have the features which provide the MAXIMUM in service—economy—safety?
- Are the radiators fabricated of 13-gauge steel?
- Are the radiators tested at the factory at 100 pounds pressure?
- Are the radiators built as an integral part of the tank, permanently welded in position, thus eliminating valves, flanges, gaskets and bolted connections?
- Does each radiator consist of a single row of tubes which can be sand-blasted, cleaned, and painted (by brush or spray) in factory or field?
- Are the tubes of the radiators uniformly shaped throughout their length, thus promoting more efficient oil circulation?
- Do the tap-changers have sliding, self-cleaning pressure contacts?
- Are the tap-changers operated by rack and gear, which eliminate back-lash and assure positive contact at all times?
- Are the coils circular and so balanced that there is no tendency for radial or axial distortion under short circuit?
- Do the coils have a low temperature gradient between copper and oil,—a feature which determines the quality of performance?

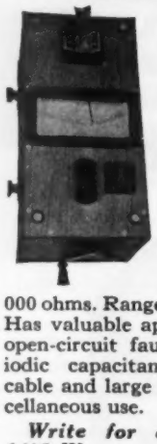
Pennsylvania answers "Yes"

Pennsylvania Transformers, incorporating these fundamental improvements, provide the maximum in service, economy and safety!

Pennsylvania Transformer Co., Pittsburgh, Pa.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.



CAPACITANCE METER

A portable direct-reading, multi-range microfarad or capacity meter with self-contained hand generator, and having the outstanding advantage of automatic compensation for parallel resistance leakage down to 10,000 ohms. Ranges up to 10 microfarads. Has valuable applications for locating open-circuit faults on cable, for periodic capacitance measurements on cable and large machines and for miscellaneous use.

Write for descriptive Bulletin 1405-W.

"DUCTER"

LOW RESISTANCE TESTING SET

A portable direct-reading instrument for quick measurements of resistance—from as low as .000001 ohm up to 5.00 ohms. Operates from a battery, the voltage of which does not have to be exact. Has valuable applications for testing bus-bar connections, for measuring switch, circuit breaker and relay contact resistances; for bar-to-bar tests on commutators, and for measuring resistances of field coils, transformer windings, etc.

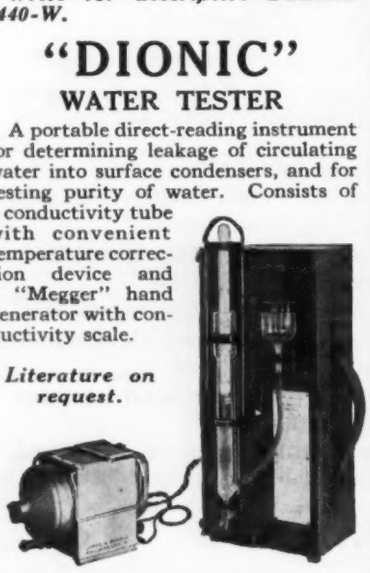
Write for descriptive Bulletin 1440-W.

"DIONIC"

WATER TESTER

A portable direct-reading instrument for determining leakage of circulating water into surface condensers, and for testing purity of water. Consists of a conductivity tube with convenient temperature correction device and a "Megger" hand generator with conductivity scale.

Literature on request.



JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Power Industry Asks Radio Frequencies

The electric light and power industry, through the Edison Electric Institute committee headed by Herbert W. Eales, has filed an application with the Federal Communications Commission for sixteen radio frequencies and two emergency allocations and for retention of the two channels now available to the companies on an emergency basis.

As an example of the companies' needs for unrestricted use of radio for system operation and trouble dispatching in the interest of safety and convenience to the public, Mr. Eales's report refers to the floods of last spring and the difficulties encountered by the companies in flooded areas.

Companies which would make use of radio for these purposes are urged by the institute to make the necessary studies of their requirements, with a view to making prompt application to the Federal Communications Commission for licenses to construct and operate the necessary stations. The company applications would relate to the frequency channels now requested for utility operations in the institute's application and would point out that the proposed radio service is only to supplement ordinary means of communication rather than to replace them.

•

More Cities Install Trackless Trolleys

Thirty new trackless trolleys, the first to be installed in that city, are now under construction at the Twin Coach Company's plant for the Milwaukee Electric Railway & Light Company. The coaches will be of the 44-passenger type. They are intended to replace rail service on North Avenue. Fifteen of the new coaches will each be equipped with a single General Electric 125-hp. motor, a rear-axle ratio of 10.61 and type M.R.A. automatic control with three points of field shunting. The heat from the resistors in the control assembly will be utilized for heating the coach interiors during cold weather.

Citizens of Flint, Mich., will soon be enjoying the comfort of modern city transportation in a fleet of 46 new trackless trolleys. Of the latest design, the new 36-passenger coaches are being built by the General Motors Truck Company and will be equipped with General Electric traction motors, control and air brakes. The new equipment will serve more than 25 miles of route and will be operated by the Flint Trolley Coach, Inc., a subsidiary of Eastern Michigan Motor buses.

THE STAR METER SEAL

MAKES METERS TAMPERPROOF

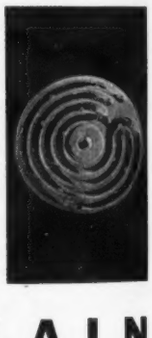
A simple, inexpensive porcelain cap that seals all type CS meters effectively and permanently—*cannot be removed without completely destroying or badly mutilating it.* Write for sample and details.

We make porcelain for all electrical insulating needs—for decorative purposes.

THERMOLAIN

Heat Resistant Refractory

Thermolain is a porous porcelain of good mechanical strength — an excellent refractory for ranges, heaters, irons, rheostats, immersion heaters, etc., where rapid changes of temperature occur.



LAVOLAIN

for Mechanical Strength

A dense, heat-resistant insulation—recommended for bushings, coils, rods and other parts requiring mechanical strength and for ovens, toasters and other equipment where high dielectric strength at high temperatures is necessary.

We make a number of porcelains for many purposes—can supply the exact material and part you need to give maximum service. Write us.

STAR PORCELAIN CO.

TRENTON, N. J.

Scroll Case Designed on Visualized Hydraulics

[*Continued from page 63*]

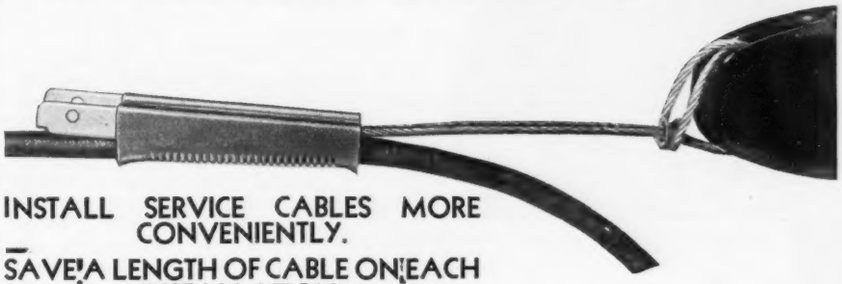
the elimination of the speed ring vortex. We also found that the model turbine would run smoother and develop more power if the water entered the distributor vane at approximately the same velocity and at the same angle. Considerable variation was made in the general design. For example, with the elimination of the two islands in Series 1, by observation both with the naked eye and the slow-motion camera, as many as 23 different directions of flow as the water approached the distributor were noted. In some cases an actual reversal of the direction of flow was revealed. In all cases where the velocity decelerated the flow seemed to wander aimlessly in all directions. The smoothest flow, the most power, the least vibration always occurred when the water accelerated uniformly and approached the distributor at approximately the same velocity through its entire periphery.

An excellent photographic study was made on Series 3 showing the distribution of water from the various channels into the speed ring. You will notice in Fig. 4 the single line from the end of the pier between the "B" and "C" channels and the distributor indicates the theoretical division of the water. By placing the sawdust in either channel the actual flow followed this theoretical curve almost exactly. This scroll was designed strictly theoretically; *i.e.*, each increment of flow was accelerated at a rate that would deliver the water to the distributor vanes at exactly the same velocity; also, the transition at each pier end had theoretically the same velocity, assuming that the flow was balanced in the three channels. This design carried more water with the same head than any of the other designs and the flow being very smooth in all parts of the model.

It must not be overlooked that the internal friction was less, as there were no islands. Several schemes were developed and all our test data corrected for the difference in internal friction. The hydraulic losses in the scroll and draft tube of a turbine of the size being installed at Bonneville is so small that it can be neglected. Variation between these losses in the prototype and the 16 and 6-in. model was considerable and allowance should be made for such differences.

Reliable

CONCENTRIC CABLE CLAMPS



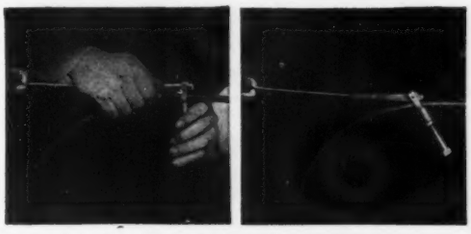
INSTALL SERVICE CABLES MORE CONVENIENTLY.

SAVE A LENGTH OF CABLE ON EACH INSTALLATION.

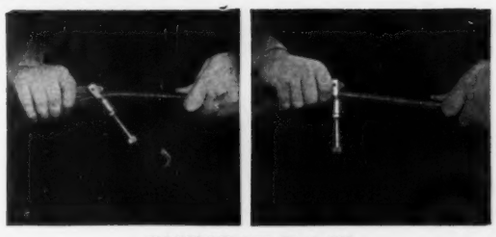
The illustrations show steps in installing Reliable Concentric Cable Clamps without cutting cable until span is sagged. Cable can then be cut to accurate length.

Tool and wedge of clamp hold cable while lineman lets go to pull up more slack. Shell of clamp is slipped on and pulled tight just before tool is removed.

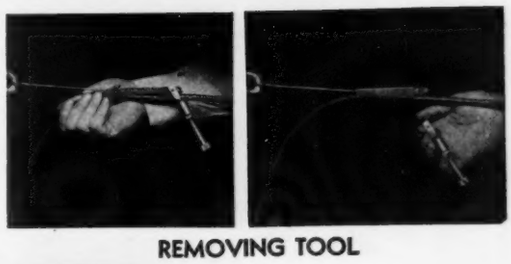
Service Cable Installing Tool For Use With Any Size Clamp.



TOOL-HOLDING CABLE



TAKING UP SLACK



REMOVING TOOL

Reliable Concentric Cable Clamps are High in Strength, Neat, Non-Corrosive, Easily Installed and Do Not Injure Cable. They are Properly Priced.

Reliable ELECTRIC COMPANY

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Located conveniently throughout the United States are 92 Page Fence Distributors who will gladly consult with you, without obligation, in best solving your fencing problem. They are prepared to recommend impartially the particular metal that will give you the best service, and to assume full responsibility for proper installation.

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BOOK REVIEWS

A Universal Stress Sag Chart (for Power Line Computations)

By J. T. Hattingh. Published by Blackie & Son, Ltd., 50 Old Bailey, London. 75 pages, illustrated, with pocket chart. Price, 12s. 6d. (net).

Rigorous mathematical derivation establishes the use of the parabolic foundation as amply accurate in the sag and stress formulas upon which the chart is based. Adoption of percentage sag is what makes the single chart for all span lengths feasible and comprehensive. The author likens the resultant universality of the chart to that of the Mollier diagram in thermodynamics. The chart embraces a single family of curves for various span lengths and another family for various values of temperature. Many examples of the universality of the chart are computed by way of illustration. In the accompanying tables of conductor characteristics, the wind force is taken as 15 pounds per square foot of projected conductor area. The chart is about 12x18 inches.

•

Inductive Co-ordination of Electric Power and Communication Circuits

By Laurence J. Corbett. Published by J. J. Neblett Pressroom, Ltd., 500 Sansome Street, San Francisco, Calif. 160 pages, illustrated. Price, $3.

Expert and active both in California and in national studies of inductive co-ordination, the author is well qualified to prepare this summary of the principles and general technique. It well sets up the factors which are involved and the methods of amelioration available. Mathematics is entirely relegated to two terse appendices and, consequently, the power and communication engineer has entirely in words what he needs to understand. Short of digesting a huge mass of papers and joint reports on the subject, one will find nowhere else a comparably compact and comprehensive exposition of the problems and the ways of meeting them. Regulatory authorities who may have been bewildered by the complexity and technicalities of co-ordination literature should also find the treatment lucid and helpful.

Especially, executives and engineers of power and communication companies and students of systems generally will find here a tolerant analytical approach to a discussion of the problems that arise out of proximity of the two indispensable utility services.

•

Menlo Park Reminiscences

By Francis Jehl. Published by Edison Institute, Dearborn, Mich. 430 pages, illustrated. Price, $0.75 plus 15 cents postage.

No one who had not joined his Menlo Park staff as early as 1878 could possibly have crammed into these 400 copiously illustrated pages so vivid and intimate a portrayal of the incidents, accidents and providences that conspired to make Edison a world figure even before he "delivered mankind from the curse of night." The author almost takes you into the musing brain of the master as the germs of such ideas as those of the printing telegraph, the carbon transmitter, antennas for Hertzian propagation (1875!!) and the phonograph inspired him. Evolution of these concepts into suc-

PROTECTIVE GROUNDS ARE BETTER EQUIPPED TO DO THEIR PART

Installed out of sight, where periodic inspection is impractical, Copperweld Ground Rods and Grounding Clamps insure the dependability of your protective grounds.

Although Copperweld Ground Rods offer the permanence of copper, because of their rust-proof copper exterior, they are nevertheless theft-proof. Also, they can be driven quickly, without bending, as the steel core of these rods makes them extremely rigid.

The great strength and high elastic limit of Copperweld Clamps enable them to maintain permanently low-resistance grounding connections.

Specify Copperweld Rods and Clamps—and guard against substitutions.

COPPERWELD STEEL COMPANY
GLASSPORT PA.

cessful working models in the face of universal scientific skepticism is then traced, all with a flavor of the human participants that reveals as little else has done, even fragmentarily, how Edison accomplished his prodigious feats.

Fully half the book is devoted to the methodical attack upon the obstinate problem of the incandescent lamp. Those who have been disposed to look upon Edison as more an empiricist than a scientist will perforce temper their attitude when they sense here how embracively he conceived not only the desired "subdivision" of light, but also the entire multiple system as we now know it, in utter defiance of the prophecies of the best of scientists. Jehl has, in this first volume (carrying up to 1880), resurrected an amazing collection of documentary illustrations of historical interest. Incidentally, they reveal how thoroughly the Edison Institute at Dearborn has become the shrine of those who honor the forefather of modern electrification principally through the diligence of Jehl and Bishop.

•

Cathode-Ray Oscillography

By MacGregor-Morris and Henley. Published by Instruments Publishing Company, 1117 Wolfendale Street, Pittsburgh, Pa. 250 pages, illustrated. Price $6.

This volume two of electrical engineering monographs appears as the first compilation of the technology of the cathode-ray oscillograph. Electronic theory is developed to the point of understanding of beam concentration and the optical correlations. The technical foundation of both the hot, and cold cathode instruments is next laid, with ample discussion of the various commercial forms. The time sweep mechanisms and voltage scaling are then taken up preceding the practical application to impulse-generator use as well as the other uses where this form is superior to the filament type, such as studies of wave reflections, fault analysis and apparatus testing.

The book is amply fortified with mathematical justification and with circuit diagrams and characteristic oscillograms, both hot and cold cathode. There is a closing chapter on television application.

•

Imports of Japanese Lamps

Exports of Japanese incandescent lamps to the United States total about 100,000,000 units annually. The number was larger in 1932, 1933 and 1935, but smaller in 1934. Detailed data on the incandescent lamp industry in Japan are assembled in issue No. 23 of "World Power Manual and Electrical Exporters' Handbook," published by the Bureau of Foreign and Domestic Commerce.

Roughly three-fourths of the number exported to the United States were miniatures. The following table, copied from the Commerce Department booklet, gives the break-down.

Type	1934	1935
Automobile	449,609	44,500
Christmas	39,973,599	70,352,973
Flashlight	24,363,636	15,701,150
Other	23,388,800	23,145,478
Total	88,186,090	108,704,601

EMERGENCY POWER SUPPLY IS IMPERATIVE

Every water works and sewage disposal plant requires secondary power.

STERLING HIGH DUTY INTERNAL COMBUSTION ENGINES

provide instant standby power for any emergency, assuring power for pumps and lights.

Sterling engines—for peak load and standby.

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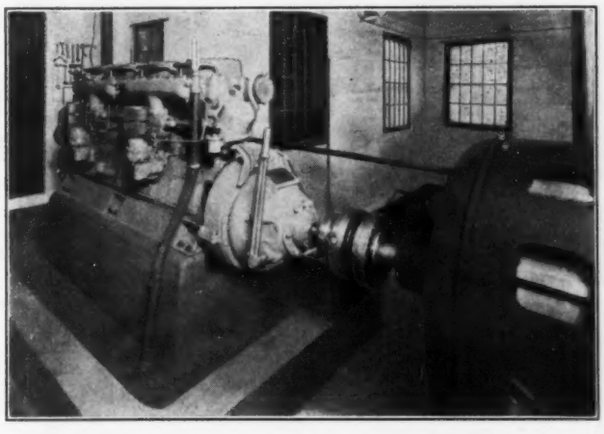

The El Paso, Texas, Sewage Disposal Plant employs a Sterling Dolphin C-8 cylinder 240 H.P. engine for standby. This engine is arranged with clutch and disconnecting coupling for quick connection in emergency.

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When Bending Conduit or Pushing Pipe— *Save Time and Money with a* GREENLEE

Hydraulic Conduit Benders

You can save time and money with a Greenlee Hydraulic Conduit Bender, because it will bend conduit faster and do a better job than by other methods. And it will do it with less effort. It is simple to operate, easy to take to the job and is popular with the workmen. By pumping the handle a shoe on the ram is forced against the conduit, which is held at two points by formed support castings. Built in two sizes for bending from 1¼" to 3" conduit and from 2½" to 4½" conduit. Can also be arranged for bending thin-wall steel conduit.

Hydraulic Pipe Pusher

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With this hydraulic pusher, one man, standing in a comfortable position, can push pipe under sidewalks, pavements, lawns, etc., simply by pumping the handles. It saves time and money on underground installations and makes it unnecessary to do extensive trenching, backfilling, tamping, etc. Because of its compact design and simple construction, it is easy to set up and move about. It operates on a notched steel base, which requires that the pipe clamp be changed only every 4 to 7 feet, depending on the length of base used. Capacity is for pipe up to 4-inch.

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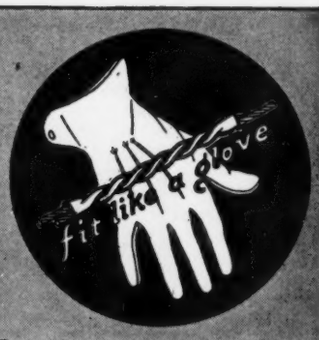
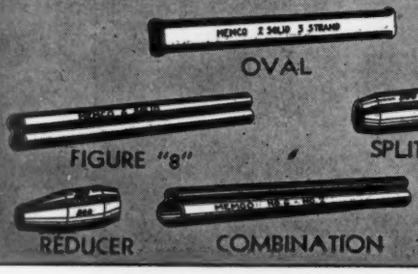
for all types of conductors





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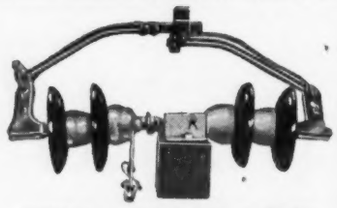

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K-P-F ELECTRIC CO.

855 Howard St., San Francisco

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Worthington Pump & Mchy. Corp., Harrison, N. J.

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Mallory & Co., P. R., Indianapolis, Ind.

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American Steel & Wire Co., Chicago, Ill.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Rockbestos Products Corp., New Haven, Conn.

CABLE, PAPER INSULATED
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Anaconda Wire & Cable Co., New York, N. Y.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
Okonite-Callender Cable Co., Passaic, N. J.
Phelps Dodge Copper Products Corp., New York
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE, PARKWAY
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Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

CABLE SERVICE ENTRANCE
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Phelps Dodge Copper Products Corp., New York
Simplex Wire & Cable Co., Boston, Mass.

CABLE, STEEL STRAND
American Steel & Wire Co., Chicago, Ill.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.